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CONTRIBUTION TO THE ICHTHYOLOGY OF THE LESSER ANTILLES.

BY EDWARD D. COPE, A. M.

(Read before the American Philosophical Society, October 7, 1870.)

The present synopsis has been prepared from the following materials. A large collection in alcohol made at the Island of St. Martin's, by Dr. R. E. van Rijgersma, of that place. A considerable collection made at St. Croix or Santa Cruz, by Dr. R. E. Griffith, of this city, the specimens mostly dried and mounted. A second collection made at the same island by Capt. Thos. Davidson of the navy, in alcohol. A collection embracing many specimens of large size, made at St. Christopher's or Kit's by our fellow citizen Benjamin H. Lightfoot. The thanks of American ichthyologists are due to these gentlemen for the liberal manner in which they have devoted themselves to the interests of this science.

An identification of the species obtained by our member, Dr. H. C. Wood, at New Providence, has been inserted, as furnishing important evidence as to the nature of the ichthyic fauna of a point so much nearer the American coast.

In general, the full determination of the fish-fauna of the North Eastern region of the Lesser Antilles, will prove of much interest to science, as furnishing a point intermediate between the ground studied so well by Professor Poey, of Havana, and the island of Barbadoes, which has furnished the collections studied by Müller and Troschel. To this end we look with confidence to Dr. Rijgersma whose interest in the various natural sciences has already produced important results in different departments. See on the Fossil Mammalia and Reptilia of Anguilla and St. Martin's, these Proceedings of this Society, 1869, pp. 183—159.

In determining these species of fishes, I have of course used chiefly the standard works of Cuvier and Valenciennes and of Günther; the latter, as bringing the history of the species of fishes more nearly up to the time, is the more important of the two. I have found the published researches of Poey on the fishes of Cuba a *sine qua non*, and the essays of Gill have furnished many important points in the higher department of the system. The Plectognath monographs of Hollard, and the writing of Bleeker on that type and the Apodes, cannot be done without in this field.

The engravings are specimens of the Bien photometallic process, and are printed with the text. They illustrate the results of photography of drawings, on metallic plates.

I. OBSERVATIONS ON THE SYSTEMATIC RELATIONS OF THE FISHES.

I. PRELIMINARY.

The system of fishes as at present adopted in this country is the result of the labors of many naturalists, but chiefly of Cuvier, Agassiz, Müller, and Gill. Without going into the history of the subject at present, it will be proper to point out the principal modifications of Cuvier's system introduced by his three successors. The orders of Cuvier, were the *Chondropterygii*, *Malacopterygii*, *Acanthopterygii*, *Plectognathi*, and *Lophobranchii*. Professor Agassiz under the name of *Placoides*, adopted the first division, the second he called the *Cycloids*, the third *Otenoids*, and then erected a fourth order under the name of *Ganoids*, which should embrace a portion of Cuvier's *Chondropterygii* (the sturgeons), a portion of the *Malacopterygii Abdominales* (the bony gars, etc.), and the two last orders of Cuvier. Professor Müller following, with a still more complete anatomical investigation, especially into the soft parts, discerned three sub-classes in Cuvier's *Chondrostomi*, which he named the *Leptocardi* (lanclet), *Dermopteri* (lamprey, etc.), and the *Selachii* (Sharks, etc.). In the then recently discovered Lepidosiren he saw on fourth sub-class, the *Dipnoi*. Having instituted an investigation of Agassiz' Ganoids, in an able memoir he purged it of the *Plectognath* and *Lophobranchiate* divisions, which are obviously not related to it. These, with the *Malacopterygians* and *Acanthopterygians*, he erected into a sixth sub-class, the *Teleostei*. This sub-class containing the greater part of existing fishes, embraced six orders, viz. : *Acanthopteri* (Cuvier's Acanthoptergians), *Anacanthini* (new, for the Cod family, etc.), *Pharyngognathi* (new,

for fishes with connate inferior pharyngeal bones), *Physostomi* (Malacopterygians of Cuvier, nearly), *Plectognathi* and *Lophobranchii* of Cuvier. The great number of facts in the anatomy of fishes added by Müller, constitute him the father of modern ichthyology.

Prof. Gill, in 1861, adopted many of the divisions of Müller, and rejected some; others were newly proposed. But four sub-classes were recognized, the *Dermopteri* which included also Müller's *Leptocardii*, the *Elasmobranchii*, equivalent to Müller's *Selachii*; the *Ganoidei*, including here Müller's *Dipnoi*, and the *Teleostei*. Six orders were attributed to the last sub-class, which were quite different from those of Müller. Thus adopting the *Plectognathi* and *Lophobranchii*, the cat fishes were erected into a new order, the *Nematognathi*; the eels into another, *Apodes*, and the ribbon-fishes doubtfully assigned to another, called *Lemniscati*. The remainder of the bony fishes were regarded as constituting the sixth and highest, or *Teleocephali*. To this as sub-orders were referred, the old orders *Physoclysti* (Acanthopteri Pharyngognathi and Anacanthini of Müller), and *Physostomi* of Müller; with the new ones *Heterosomata* (the flat fishes), and *Eventognathi* (the Cyprinidæ).

Subsequent to this publication, important contributions to the system have been made by Agassiz, Kner, Lütken, Gill, Huxley, etc., which will be noticed at the proper time.

The writer having been engaged in an examination of the osteology of the bony fishes, and general anatomical structures of the whole, has proposed to point out some further modifications of the received system, which he believes will render it a closer reflection of nature. There are some portions of the skeleton which have been to a great extent overlooked in seeking for indications of likeness and difference of types, and the estimation in which many known characters are held, may be much altered on the study of extended material. The skeletons on which the present study is made are 1000 in number, 200 belonging to the Academy of Natural Sciences, of this city, and 800 to the writer, being the collection made by Professor Joseph Hyrtl, the distinguished anatomist of Vienna. This collection has been long known to anatomists in Europe as the most beautifully and reliably prepared in existence, and as valuable as any, for study, on account of the fulness of the representation of the various types.

2. SPECIAL ON THE GANOIDS.

Recurring to Müller's system, the writer adopts, as characterized beyond dispute, his sub-classes or orders of *LEPTOCARDII*, *DERMOPTERI*, *SELACHII* and *DIPNOI*, and confines himself at present to the recent *Ganoidea* and *Teleostei*. I have shared in the doubts occasionally expressed by ichthyologists, as to the essential distinction of these latter divisions, and an examination into the osteology, with reference to this point, confirms the doubts raised by a study of the soft parts. As is well known, Müller distinguished the *Ganoidea* by the muscular bulbous arteriosus containing numerous valves, and the connection of the optic nerves by commissure rather than by decussation. He added several other characters, knowing them, however, to be shared by various other orders and subclasses, and I have selected the only two which seemed to be restricted to the division. Their restriction to it, however, is only apparent, and Kner points out that the peculiarity of the optic commissure is shared by some *Physostomi*, and that the difference between the number and character of the valves of the bulbus in *Lepidosteus* and *Amia* is quite as great as that existing between *Amia** and some of the *Physostomi*. After an examination of the skeleton, it is obvious that, in this part of the organism also, there is nothing to distinguish these fishes from the *Teleostei* of Müller. It is true that each of the genera referred to it possesses marked skeletal peculiarities, but they are either not common to all of them, or are shared by some of the *Physostomi*. If, on the other hand, we compare these genera with each other, differences of the greatest importance are observable, which at once distinguish two divisions, one represented by *Polypterus*, the other by *Lepidosteus* and *Amia*.

In the first place, the basal radii of the pectoral fins of *Polypterus* are observed to be excluded from articulation with the scapular arch by the intervention of three elements, which form a pedicel or veritable arm for the fin; in *Lepidosteus* and *Amia* the radii are sessile on the scapular arch as in ordinary fishes. The ventral fins present a like difference; the basal radii are long, and four in number in *Polypterus*. In the other two genera they are absent, excepting one rudimental ossicle on the inner basis of the fin (two in *Lepidosteus*), precisely as in the *Physostomous* families *Mormyridæ*, *Catostomidæ*, etc. If we examine the branchial apparatus, we find an undivided ceratohyal, three branchial arches, and no inner and but two outer bones of the superior branchiyls present in

* See Franque Nounul, ad *Amia* calvum, Tab. 1, fig. 10.

Polypterus. In *Lepidosteus* and *Amia*, we have the double ceratohyal, four branchiyl arches with four outer and four inner superior elements, all characters of the typical *Teleostei*. The maxillary bone of *Polypterus* instead of being free distally as in fishes generally, is united with an ectopterygoid, and with bones representing, in position at least, postorbital and malar. In the other genera, the relations of the maxillary are as in osseous fishés.

The sturgeons, *Accipenseridae*, agree with *Amia*, etc., in all of these points but one, differing only in having the superior ceratohyal and several of the superior branchiyls cartilaginous. The one point of distinction is, the extension of the basal radial supports of the ventral fin all across its basis, as in *Polypterus*. The pectoral fin is, on the other hand, much as in *Lepidosteus*. Thus the sturgeons combine, in this one respect, the features of both divisions. Both the basal ceratohyals are cartilaginous in this family; the superior only is cartilaginous in *Polypterus*, *Lepidosteus* and *Amia*, while both are ossified in the old *Teleostei*, except in the eels. In these, the inferior is cartilaginous, while the superior is coössified to the ceratohyal. Thus in one unimportant character *Polypterus* agrees with its former associates, but differs more from others of them, the sturgeons, than from the bony fishes. Another character of both *Lepidosteus* and *Amia* betoken a certain relationship to *Polypterus*, viz.: the complexity of the mandible, especially in the possession of a coronoid bone. But here, again, *Accipenser* only possesses an osseous dentary, while *Gymnarchus* and *Gymnotus* have the angular and articular bones distinct from the dentary, wanting the coronoid and opercular. In most bony fishes the angular is not distinct.

It is thus evident that the sub-class Ganoidea, cannot be maintained. It cannot even be regarded as an order, since I will show that *Lepidosteus*, *Accipenser* and *Amia*, are all representatives of distinct orders. I hope also to make it evident that *Polypterus* should be elevated to the rank of a sub-class or division of equal rank with the rest of the fishes, and with the *Dipnoi* already adopted.

3. RELATIONS TO OTHER VERTEBRATA.

The primary divisions of the vertebrata as expressed by the skeleton, have been defined by Huxley in a very satisfactory manner, up to a certain point. Thus the MAMMALIA are distinguished by the reception of the proximal bones of the mandibular arch into the auditory capsule, as *ossicula auditus*, and by the absence of distinct coracoid bone. The ear-bones support the under jaw in the groups that follow, and a separate coracoid bone exists. The division of birds and reptiles together, or SAUROPSIDA, possesses limbs with but few and special radii, an osseous basis cranii, without parasphenoid bone, and one aorta root or two of one bow on each side (rarely a second bow). The division next below, or BATRACHIA, was shown to possess no osseous basis cranii, whose place is taken by the membrane bows, the parasphenoid: limbs with but few radii, and an aorta originating from two roots, attached to which are three or four bones on each side.

Following these, is the great group of fishes, in which the limbs are many rayed or jointed, or fins; a parasphenoid present, and pelvis generally wanting. The stapes, which has not in the preceding groups shared in the support of the mandible, is now projected from the brain case so as to share with the malleus (quadrate) in this support, being still the proximal element in the hyoid arch, as in the preceding classes. There are five (rarely four) aorta bows which unite to form the aorta root on each side. The cranium is cartilaginous or osseous, and the mandibular arch present. Below these come the DEMOPTERI, where the limbs are wanting, and the mandibular arch absent: the cranium cartilaginous. In the lowest group or LEPTOCARDII, there is no differentiated brain, the cranium is membranous and without arches: limbs wanting, and five aorta bows as in the last division.

These six classes of vertebrata appear to be well established. The question remains as to whether naturalists are correct, who regard the fishes as representing variously from two to four classes. One of these (the Ganoidea) having been already disposed of, it remains to consider the claims of the remainder, viz.: the Elasmobranchii (sharks) Dipnoi and typical fishes.

If we examine the points in which the whole, taken together, differs from the *Batrachia* and other classes above it, we find that it is confined chiefly to the structure of the limbs and the hyoid apparatus. The typical fishes present, however, other important peculiarities, viz.: 1st. The existence of two or three distinct bones in the suspensor of the mandible, instead of one; 2d. The attachment to these of the opercular bones; 3d. The absence of pelvic bones; 4th. The suspension of the scapular arch to the cranium; 5th. The large development of the pterotic (Parker, *Mastoid*, Cuvier, and Owen) is characteristic of bony fishes,

The types of variation in the first point, only distinguish groups of subordinate rank. Thus the suspensor of the mandible in the typical fishes consists of the hyomandibular (stapes), quadrate (metapterygoid or incus), symplectic and mesopterygoid (quadratojugal Müller, quadrate Huxley, Elem. Comp. Anat.). In the *Mormyridæ*, *Siluridæ*, *Polypteridæ* (scap. arch), and others, the symplectic is absent; in the eels of several families, both it and the metapterygoid are wanting, reducing the suspensorium to a rod of two pieces. This condition exists in many of the rays; in others, and in the sharks, the inferior element is wanting (Müller Stannius). An important modification is exhibited by *Chimæra*, where the hyomandibular, which alone exists, is continuous with the cartilaginous cranium, not being separated by the usual articulation. As to the opercular bones, all are wanting in the Elasmobranchs (sharks and rays), while the typical fishes possess four, viz.: preoperculum, operculum, suboperculum, and interoperculum. In many of these, however, the suboperculum is wanting, and in the sturgeons and many eels there is no preoperculum. In *Polyodon* the interoperculum is also wanting. In *Lepidosiren* the operculum and interoperculum are rudimental. In respect to this point, also, the divisions indicated are of subordinate value. As regards the development of the pterotic bone, its history is not yet sufficiently made out to enable us to understand its value. It does not exist in those with cartilaginous cranium (*Elasmobranchii*). The Elasmobranchs are well known to have the scapular arch suspended freely behind the cranium as in higher vertebrates. It is not always attached to the cranium, on the other hand, among true fishes, for in the eels it is quite as in the sharks, and the spinous finned *Mastacembelus* presents the same feature.

The character presented by the pelvic bones and limbs seem to be of higher import. Thus all the bony fishes and sturgeons lack all the pelvic elements. In the sharks and rays they are also wanting, but two elements on each side appear in the *Holocephali* (*Chimæra*), according to Leydig and Gegenbaur. In *Lepidosiren*, a large median pelvic cartilage exists, but which element it represents is unknown. This is evidently a character of high significance. As to the limbs, the peculiarities of *Polypterus* have been pointed out above. They mean nothing less than the development of the elements of the arm and leg of the higher Vertebrata, which intervene between the point of articulation and the distal segments, in *Polypterus* and the sharks and rays. In the former, the distal segments are articulated exclusively to the extremities of the proximal pieces, which thus resemble, as well as represent, humerus and femur, and render the limb pedunculated. The proximal pieces are not continued distally, however, into the representatives of the main axis, which, as demonstrated by the admirable studies of Gegenbaur, consist, after humerus, of radius, inner tarsals and metatarsals, and thumb; in the hind limb, of the line of the tibia and inner toe. This continuation is observed in the Elasmobranchs, where, however, the divergent segments extend along the sides of the proximal pieces to near, in some *Rajidæ* quite, to the articulation with the scapular arch. In the true fishes, including some of the old ganoids already considered, the divergent rays always reach this articulation, while the number of proximal or basal pieces is diminished. These pieces have been called by Gegenbaur the Metapterygium (humerus), Mesopterygium, and Propterygium; the first being axial, the second and third being divergent from it. In *Polypterus*, the Propterygium and Mesopterygium are largely developed; in sharks and rays the propterygium is sometimes small, sometimes wanting, while in the true fishes the propterygium and mesopterygium are both wanting, except in *Amia*, *Lepidosteus*, and the sturgeons, where a cartilaginous mesopterygium exists, according to Gegenbaur. This author finds it rudimental in young *Salmonidæ* and *Siluridæ*. Lastly, in the true fishes the distal elements of the axis of the limb are wanting just as in *Polypterus*.

In Dipnoi, on the other hand, we have this axis complete, or rather with greatly multiplied distal segments, and with uni- or bilateral radii. The bilateral type is seen in *Ceratodus* and the acute-lobed *Crossopterygia*, according to Günther. Hence the limb in this order is termed by Owen, the simplest or primary type, and this proposition is abundantly confirmed by the beautiful researches of Gegenbaur. The foundation for the history of the genesis of limbs laid by this author, will ever be a land-mark in the history of modern theories of creation.*

Important as are the characters that distinguish the several groups indicated by the different types of structure of the limbs and pelvis, they do not seem to me to warrant their recognition as classes, equivalent to those of the six already pointed out. Taking them together, there is a greater coherence also in the structure of the brain and circulatory systems than is held to be the case with any other two of the classes adopted above. The peculiarities of the limbs, important as they are, are quite similar in the want of the high specialization of their parts seen in the

*See his memoir Ueber das Skelet der Gliedmaassen der Wirbelthiere im Allgemeinen, etc. Jenaische Med. Zeitschr. Vol. V. p. 397.

Batrachia and higher classes, the differences consisting rather of number and position of parts. The pelvis of the *Dipnoi* might be regarded as of primary importance but for its existence in the *Holocephali*, whose limbs again are so near those of the sharks. It remains, therefore, to adopt the Linnaean and Cuvierian class PISCES, and to grant as sub-classes the groups of *Holocephali*, *Selachii* and *Dipnoi*. There remain as sub-classes the groups typified by *Polypterus* on the one hand, and the true fishes on the other. The first has been already distinguished in its external characters by Prof. Huxley, who again brought light out of obscurity when he established "his third sub-order of Ganoids, the *Crossopterygida*."* This division is in my estimation a natural one, and to be elevated to a rank equivalent to that of each of the three aboved named, being the only part of the original division of Ganoids of Agassiz entitled to it. Prof. Huxley defined it as follows: "Dorsal fins two, or if single, multifid or very long; the pectoral and usually the ventral fins lobate; no branchiostegal rays, but two principal with sometimes lateral and median jugular plates situated between the rami of the mandibles; caudal fin diphyccercal or heterocercal; scales cycloid or rhomboid, smooth or sculptured."

Of the above characters, that which relates to the lobate fins is the essential one, and is the expression of the external appearance produced by the structure of the bones of the limbs already pointed out by Gegenbaur. The dorsal fins of some families it is true, possess a remarkable structure, but in *Phaneropleuron*, Huxl. and some others, appears to be nearly like that of the *Dipnoi*. The absence of branchiostegal rays is important, but is shared by the sturgeons. The jugular plates appear to exist in *Polypterus* only among recent fishes, though several, as *Amia*, *Elops*, *Osteoglossum*, etc., possess a median one. Nevertheless, its nature would not lead one to anticipate its being a constant feature in any group of high rank; at least such is our usual experience with dermal bones. The structures of the skin and scales given by Huxley are very subordinate.

The remaining division answers then to the Teleostei and Ganoidea of Müller, minus *Polypterus*. The name Teleostei cannot be preserved for this division owing to its entire want of coincidence with that division of Müller, as well as from the fact that the cartilaginous sturgeons must be included in it. I propose, therefore to call it the *Actinopteri*.† The characters of the five sub-classes will then be as follows:

Class PISCES.

The hyomandibular bone continuous with the cartilaginous cranium, with a rudimental opercular bone. Two distinct pelvic bones on each side. Derivative radii sessile on the sides of the basal bones of the limbs, separated from the articulation.

HOLOCEPHALI.

Hyomandibular bone articulated with the cranium; no opercular pelvic bones. Derivative radii sessile on the sides of the basal bones of the limbs, rarely entering articulation.

SELACHII.

Hyomandibular bone articulated; rudimental opercular bones. A median pelvic element. Limbs consisting of the axial line commencing with the metapterygium and with multiplied axial and often lateral segments.

DIPNOI.

Hyomandibular articulated, opercular bones well developed, a single ceratohyal; no pelvic elements. Limbs having derivative radii of the primary series on the extremity of the basal pieces, which are in the pectoral, metapterygium, mesopterygium, and propterygium.

CROSSOPTERYGIA.‡

Opercular bones well developed on separate and complex suspensorium; a double ceratohyal, no pelvic elements. Primary radii of fore limb parallel with basilar elements, and entering the articulation with scapular arch. Basilar elements reduced to metapterygium and very rarely mesopterygium. Primary radii of posterior limb generally reduced to one rudiment.

ACTINOPTERI.

The only sub-classes considered here are the last two.

*See Mem. Geolog. Survey United Kingdom Decade x. p. 23.

† From $\alpha\tau\lambda\iota\varsigma$ a radius, and $\pi\tau\epsilon\rho\omega\nu$ fin or wing, from the support of the fins by the radial elements only.

‡ Altered from Huxley's *Crossopterygida*.

4. ON THE CROSSOPTERYGIA.

My object in alluding to the present subclass is to point out the ordinal characters of *Polypterus* as compared with others of the same primary division, and of the *Actinopteri*. The elucidation of this point depends first on the explanation of the structure of the dorsal fin. This is one of the most extraordinary peculiarities of the genus in question, and has never been brought into harmony with that exhibited by other divisions of fishes so far as I am aware. The dorsal fin of *Polypterus* consists of a number of independent pinnules. Each of these consists of a strong spinous ray supported by a single interneural bone. From the posterior face of the ray projects a number of soft or cartilaginous rays, obliquely backwards, forming a vertical series. Thus results a series of vertical dorsal fins standing on end instead of horizontally as in other fishes. The significance of this structure appears to be as follows :

In the *Dipnoi*, we observe the archetypal fin almost realized. Each neural spine bears an interneural bone, and each interneural a basal radial bone. Beyond these are the numerous distal or cartilaginous radii, which greatly exceed in number the interneural bones. In the Dipnoan *Phaneropleuron*, according to Prof. Huxley's figure and description, each interneural supports a basal radial, and this in its turn a number of true radii. In the caudal fin of *Polypterus* as we pass towards the dorsals we find the transition from the rays with jointed, forked extremity continuous with the base, to the dorsal pinnules, to be complete.* The basal portion of the ray loses its jointed character, and more in front than posteriorly ; the anterior surface becomes sculptured like the spines that support the pinnules, and the sides begin to project in an angle which, in the next spine, becomes a free margin. The apex, separating at the first joint from its terminal, jointed portion, the latter appears to issue from a fissure in its apex. In the next spine, this fissure is prolonged downwards on the posterior face, and the jointed divisions are more widely separated. Their number also is increased in each by the continuation of a fissure which divided the upper ray of the last pinnule above described, for about half its length to the base. In the anterior pinnule the inferior, now horizontal, ray is considerably nearer the base of the spine than in those nearer the tail.

The preceding succession displayed by the pinnules from behind forwards is no doubt a developmental one, representing truly the origin of the more specialized, since the rays of the tail are unquestionably in the primitive condition already stated to characterize the dorsal fin of *Phaneropleuron*. It has also a complete analogy to the succession which we trace in the types of the pectoral fin, commencing with the simple axis of the *Dipnoi*, and passing to the axis with lateral appendages or radii, seen in *Selache* (Gegenbaur l. c.) and that traced below in the caudal.

Carrying the process on, in the line already commenced, if we bring the radii to the plane of the basis of the basal ray or spine, we have the number of rays in the basal radial band greatly increased. Should they ossify, as we have seen them to do in passing from the caudal to the dorsal fins of *Polypterus*, they would be undistinguishable from the basilar rays, just as the primary rays of the pectoral fin in the *Crossopterygia* are undistinguishable from that which was originally the axial. I am not at present acquainted with any genus of this sub-class which presents this character without modification ; but if we omit a large number of the interneural spines and their increased basilar rays, all but four in fact, we have exactly the structure presented by the members of the family of the *Cælacanthus*, as figured by Huxley and Egerton, l. c., or the genera *Tristichopterus*, *Cælacanthus*, *Undina* and *Macropoma*. In several of these the interneural spines are united in pairs, thus supporting two dorsal fins. No doubt others of the order possess this structure, and some intermediate between it and some of the forms already described. We have thus a successional specialization in the structure of the dorsal fin represented by three types, the first being nearest to the *Dipnoi*, the last (*Polypterus* and *Tristichopterus*) being specialized so as to resemble the paired fins, much more so in fact than anything observed in the *Actinopteri*. The three orders may by thus described.

Basal radii equal in number to the interneural spines, with the radii divergent from their extremities. Interneural bones numerous. HAPLISTIA.

Basal radii equal in number to the interneural spines ; the distal radii divergent from the posterior margin of the former ; interneural bones less numerous. CLADISTIA fam. *Polypteridæ*.

* This is more obvious in some specimens than others ; one from Gondokoro on the upper Nile is most instructive in this respect,

Basal radii much more numerous than the interneural bones radiating from their extremity and continued into branching distal radii; interneurals much reduced in number. ACTINISTIA, fam. *Coelacanthidæ*.

The basilar segments are entirely wanting in the higher *Actinopteri*, but are variously present in the lower. They are rudimental in the dorsal fin of *Amiurus*, and are more distinct in the dorsal fin of *Gymnarchus* and *Carpiodes*. They are well developed, but short in the dorsal and anal fins of *Coregonus*, *Salmo*, *Elops*, *Mormyrus*, *Osteoglossum*, and even in the spinous rayed *Batrachus*. They are small in the anal fin of *Hydrocyon*. In *Amia* they are long in the anal, but wanting in the dorsal fin. Finally, in the sturgeons they are well marked, but imperfectly ossified in both dorsal and anal fins. In most Clupeidæ and Characinidæ they are not visible, and are wanting in *Heterotis*, *Butyrinus* and *Hyodon*. In all cases where they are present, however, they are greatly more numerous than the vertebrae, as are also the interneural bones.

The origin of this increase suggests itself, and leads back to the proposition discussed with reference to the increase seen in the *Coelacanthidæ*. Should a type of this group be discovered with dorsal fins or pinnules as numerous as those of *Polypterus* and with the structure of those of *Tristichopterus*, we would then be with reference to our increase in the number of interneural bones, nearly where *Polypterus* places us with reference to the increase of the basal segments. We may then suppose that the most divergent of the supernumerary basilar became lateral on the interneural adjacent to each, by the shortening of the axial basilar. That this shortening has taken place, is obvious from the condition in which we find it in the many genera mentioned, and that its effect would be to throw the lateral basilar on to the interneural is almost a necessity. We have thus the high number of interneurals seen in the *Actinopteri* accounted for, and though as yet largely hypothetical, the explanation seems extremely probable.

5. ON THE ACTINOPTERI.

In determining the primary types of this sub-class, we recur to some characters already mentioned, in which they approximate the *Crossopterygia*, and adding others, follow the various divergences to their specialized terminations.

Thus in *Accipenser* and allies the ventral fins possess a complete series of basal radial bones, and the pectorals each a large mesopterygium. In *Amia* and *Lepidosteus*, the mesopterygium is small and the basal radii of the ventrals are reduced to their lowest number. In none of them are the basihyals fully developed. Most of the eels retain a character which we have only observed heretofore in the *Selachii*.

We pass by a number of the lower fishes before we find the mandibular arch furnished with a symplectic. One of the most important modifications, which is more or less coincident with a number of others, is that which formed the basis of Bonaparte and Müller's order of *Physostomi*. The presence of the ductus pneumaticus which characterized it is always associated with an abdominal position of ventral fins and cycloid scales, and mostly with the presence of the præcoracoid arch, the entrance of the maxillary bone into the border of the mouth and the non separation of the parietal bones by the supraoccipital. Yet none of these characters are precisely associated at the point of change in each, for there are Physostomous fishes with separated parietals and ctenoid scales (some *Cyprinodontidæ*) and there are Physoclysti with abdominal ventrals. Nevertheless three prominent types stand out in the *Actinopteri*, the sturgeons or *Chondrostei*, the *Physostomi*, and the *Physoclysti*, and may be considered as tribes.

An entire series of basilar segments of the abdominal ventral fin; no branchiostegal rays.

CHONDROSTEI.

Basilar segments of ventrals rudimental, position of fins abdominal, parietal bones usually united; branchiostegal rays; swim bladder connected with the stomach or oesophagus by a ductus pneumaticus. PHYSOSTOMI.

No ductus pneumaticus; parietal bones separated by the supraoccipital; ventral fins usually thoracic or jugular; no basilar segments.

PHYSOCLYSTI.

CHONDROSTEI.

There are two orders in this division, as follows:

A præcoracoid arch; no symplectic bone; premaxillary forming mouth border; no suboperculum nor præoperculum; mesopterygium distinct; basihyals and superior ceratohyal not ossified; interclavicles present. No interoperculum or maxillary bones; branchiaryals cartilaginous.

1 SELACHOSTOMI.

Similar to the last, but with interopercle and maxillary bones, and osseous branchielyals.

2 GLANIOSTOMI.

The first order embraces the single family of *Spatularidæ*, the second, that of the *Accipenseridæ*. In both, the chorda dorsalis persists, the tail is heterocercal and the osseous cranium is little developed. The basal and radial elements of the limbs, with the coracoids, are not ossified.

PHYSOSTOMI.

The following key will express the leading features of the orders of this division.

I A præcoracoid arch.

A A coronoid bone.

Maxillary in many pieces; vertebræ opisthocælian.

3 GINGLYMODI.

Maxillary not transversely divided; vertebræ amphicælian.

4 HALECOMORPHI.

AA No coronoid bone.

* No symplectic bone.

Pterotic simple, anterior vertebræ with ossicula auditus; supraoccipital and parietals co-ossified.

5 NEMATOGNATHI.

Pterotic annular, including a cavity closed by a special bone; parietals distinct, vertebræ simple.

6 SCYPHOPHORI.

** Symplectic present.

Anterior vertebræ co-ossified and with ossicula auditus.

7 PLECTOSPONDYLI.

Anterior vertebræ similar distinct, without ossicula auditus;

8 ISOSPONDYLI.

II. No præcoracoid arch.

A Scapular arch suspended to cranium.

* A symplectic.

Pterotic and anterior vertebræ simple; parietals separated by supra-occipital.

9 HAPLOMI.

Anterior vertebræ modified; parietals united; pectoral fins.

10 GLANENCHELI.

** No symplectic.

Anterior vertebræ simple; a præoperculum and maxillary; no pectoral fins.

11 ICHTHYOCEPHALI.

A A Scapular arch free behind the cranium.

* A præoperculum.

A symplectic; maxillary well developed; no pectoral fins.

12 HOLOSTOMI.

No symplectic; maxillary lost or connate; pectoral fins.

13 ENCHELYCEPHALI.

** Præoperculum wanting or rudimental.

No symplectic, maxillary, nor pectoral fins; no pterygoid.

14 COLOCEPHALI.

Of the above orders, the *Haplomi* (pike, etc.,) approach nearest the *Physoclysti* of the families *Ophiocephalidæ* and *Atherinidæ*; and the *Holostomi* of the family *Symbranchidæ* to the *Physoclyst* family of *Mastacembelidæ*. The affinities between these families is, in both cases, so close as to render the distinction of the primary divisions in question hardly worth preserving.

The complete development of the support of the caudal fin is seen in many members of this tribe, while in many of them it remains in its primitive condition. Among *Physoclysti* it is nearly always complete, though in a few (*Trichiuridæ*, etc.,) it remains larval.

In the first development of the vertebral column in fishes, it forms a straight axis. The fin is represented by a fold of the integument, which extends equally round its extremity. In this membrane the rays are developed, and in many fishes they remain thus equally distributed. In this case, the caudal vertebræ remain in a straight line to the extremity, and we have a termination such as is seen in *Lepidosiren* and the eels. This form of tail may be called the *isocercal*.

If now, the radii, basal or distal acquire a greater development on the lower side of the end of the column, those

on the upper side remaining rudimental, it will be necessary that such enlarged portion should strike the water in the plane transverse to the longitudinal axis of the body, in order that the weight of the body be propelled with the least expenditure of force. This will necessarily cause the distal vertebræ or end of the chorda dorsalis to be turned upwards, so that the inferior rays of the fin shall be brought as near to the line of the superior as possible. This is the type of tail known as the *heterocercal*, as called by Agassiz.

We find among the *Physoclysti* that the lower rays of the fin are more and more strengthened, and the hæmal spines which support them are more and more enlarged; consequently the end of the column is more curved upwards, as seen in *Amia*. The superior rays and neural spines are also strengthened, and the inferior so extended upwards as to pass round the extremity of the column, and come into contact with them. And now the vertebral centra are successively atrophied from the extremity. Counting from the extremity to the hæmal spines of the first supports of the outer rays of the caudal fin above and below, we find that ten vertebræ remain in the tail of the *Notopterus*. In the *Hyodontidæ* *Albulidæ*, *Elopida*, *Alepocephalidæ* and *Salmonidæ*, there are but two left, while one only appears in the *Osteoglossidæ*, *Aulopidæ*, *Lutodiridæ*, *Butyrinidæ*, *Coregonidæ*, *Clupeidæ* and *Chirocentridæ*. In most other families, especially of *Physoclysti*, the last one has disappeared, and the numerous hæmal arches are arranged like radii diverging upwards and downwards from the last caudal vertebræ. In the highest groups, as *Pharygognathi*, etc., they become coössified, and the tail has completed its specialization. This is the type called homocercal by Agassiz, and diphycercal by later writers.

These types are thus plainly stages in the development of this member, the first and second being simply of development of the last. Thus the young Salmon commences with an eel-like vertebral column, or is *isocercal*; it presently, by the upward curvature of the column, and unequal development of the caudal fin becomes *heterocercal*. Aborting the distal vertebræ, it makes much progress towards becoming *diphycercal*, but ceases to grow before it has quite accomplished this stage. The *Polypterus*, the eels, the *Gymnarchus*, and other fishes ossify the vertebræ in the isocercal stage. The *heterocercal* type is seen in the *Chondrostei*, where the vertebræ never ossify. In *Lepidosteus*, *Amia* and *Salmo*, they ossify in this stage.

I will now further specify the characters of the orders of *Physostomi*, and the families they contain.

INGLYMODI. Parietals in contact; pterotic simple; symplectic present. Mandible with coronoid, opercular, angular, articular and dentary bones. Basis cranii simple. Third superior pharyngeal bone small, lying on fourth; upper basihyal wanting. Maxillary subdivided. A præcoracoid arch. Vertebræ opisthocælian. Pectoral fins with mesopterygium and five other basal elements.

One family, the *Lepidosteidæ*, with heterocercal tail, cartilaginous præcoracoid, one axial hyoid and three basal branchiylals.

HALECOMORPHI. Parietals in contact, pterotic basis cranii and anterior vertebræ simple. Mandible with opercular and coronoid; maxillary not segmented, bordering the mouth. Third superior pharyngeal lying on enlarged fourth; upper basihyal wanting. Vertebræ amphicælian. Pectoral fins with mesopterygium and eight other elements.

One family, the *Amiidæ*, with heterocercal tail, cartilaginous præcoracoid, one axial and four basal branchiylals.

NEMATOGNATHI. Parietals and supraoccipital confluent. Four anterior vertebræ coössified, and with ossicula auditus. Nomesopterygium. Basis cranii and pterotic bone simple; no coronoid bone. Third superior pharyngeal bone wanting or small and resting on the fourth, second directed backwards. One or two pairs basal branchiylals, two pairs branchiylals. Suboperculum wanting, premaxillary forming mouth-border above. Interclavicles present.

This division is the nearest ally to the sturgeons (*Chondrostei*) among Physostomous fishes, and I imagine that future discoveries will prove that it has been derived from that division by descent. In the same way the Isospondylous fishes are nearest to the *Halecomorphi*, and have probably descended from some *Crossopterygian* near the *Haplística*, through that order. The affinity of the cat fishes to the sturgeons is seen in the absence of symplectic, the rudimental maxillary bone, and as observed by Parker, in the interclavicles. There is a superficial resemblance

in the dermal bones. The rudimental mesopterygium shown by Gegenbaur to exist in the young *siluridæ*, the præco-racoid arch and the ventral fins, are shared with the sturgeons and other divisions.

There are considerable varieties of type in subordinate features to be observed in the Nematognathi. The *Hypophthalmidæ* are indeed scarcely to be referred to this order.

- 1 Anterior vertebræ modified ; inferior pharyngeal bones distinct ; few branchiostegal radii ;
Operculum present. *Siluridæ*.
Operculum wanting. *Aspredinidæ*.
- 2 Vertebræ unmodified ; inferior pharyngeal bones united their whole length many branchiostegal rays ;
Operculum present, *Hypophthalmidæ*.

In the *Siluridæ* we have other modifications of importance. Thus in *Plotosus* the second superior pharyngeal is wanting. In *Loricaria* and its allies, the pterotic is greatly expanded, so as to unite with the hyomandibular and opercular bones.

SCYPHOPHORI. Parietals narrow, distinct from each other and the supraoccipital. Pterotic large funnel-shaped, enclosing a chamber which expands externally, and is covered by a lid-like bone. No symplectic. Opercular bones present. Anterior vertebræ unaltered. No mesopterygium. Basis cranii simple. No interclavicles.

This very distinct group is about equally allied to the preceding and the following. The arrangement of the parietal bones appears to explain that of the *Siluroids*, about which there is some difference of opinion among naturalists. Thus Huxley in his memoir on the Ganoids, in his figure of *Clarias*, labels these confluent elements (as I suppose them to be at present), supraoccipitals ; Parker (shoulder girdle), calls them parietals. The families of this order are two, viz:

- Tail isocercal, *Gymnarchidæ*.
Tail diphyccercal, *Mormyridæ*.
In *Mormyrus* there is one vertebra of the original series left in the tail.

PLECTOSPONDYLI, Parietals broad, distinct, pterotic normal, symplectic present. Opercular bones all present ; no interclavicles. Anterior four vertebræ much modified and with ossicula auditus.

- 1 Brain case produced between orbits ; only two superior pharyngeal bones ; basis cranii simple.
a Only two basal branchielyals.
Tail diphyccercal, *Catostomidæ*.
a a Three basal branchielyals,
Tail diphyccercal, { *Cyprinidæ*.
{ *Cobitidæ*.
Tail isocercal, *Sternopygidæ*.

2 Brain case not produced between orbits, basis cranii double, with muscular canal in many ; four to one superior pharyngeal bones.

- Three basal branchielyals, { *Characinidæ*.
{ *Erythrinidæ*.

ISOSPONDYLI. Parietals separate, symplectic present ; no interclavicles. Anterior vertebræ simple, unmodified. Pharyngeal bones separate above and below.

An extensive group, presenting many subordinate modifications.

- 1 Tail subisocercal ; pterotic externally annular enclosing a large cavity ; basis cranii double ; *Notopteridæ*.
- 2 Tail diphyccercal ; pterotic normal, basis cranii double ; superior pharyngeals four, distinct, third largest directed forward ; basal branchielyals three : (typical.)
* Parietals united.

Two tail vertebræ,

One tail vertebra,

No tail vertebræ,

* * Parietals separated by supraoccipital.

Two tail vertebræ,

One tail vertebra,

3 Tail diphyccercal, pterotic normal, basis cranii simple.

Basal branchiylals and superior pharyngeals each three ;

The same bones each two ;

{ *Hyodontidæ*.
{ *Albulidæ*.
{ *Elopida*.
{ *Aulopida*.
{ *Coregonidæ*.
{ *Lutodiridæ*.
{ *Sauridæ*.
{ *Gonorhynchidæ*.

{ *Alepocephalidæ*.
{ *Salmonidæ*.

{ *Chirocentridæ*.
{ *Clupeidæ*.

Osteoglossidæ.

{ *Heterotidæ*.
{ *Galaxiidæ*.

HAPLOMI. No præcoracoid arch. Parietal bones separated by the supraoccipital. A symplectic; opercular bones present; anterior vertebræ unaltered. Pharyngeal bones distinct, the superior directed forwards, three or four in number. No interclavicles.

1 Basis cranii double; maxillary entering mouth border.

2 Basis cranii simple; maxillary bounding mouth.

3 Basis cranii simple; mouth bounded by premaxillary only; third upper pharyngeal enlarged. { *Cyprinodontidæ*.
{ *Hypsoidæ*.

Esocidæ.

Umbridæ.

GLANENCHELI. Parietal bones extensively in contact, distinct; pterotic normal; a symplectic. Opercular bones complete; mouth bounded by premaxillary chiefly: six or seven basilar pectoral rays. No præcoracoid or interclavicles. Anterior vertebræ united, modified, and with ossicula auditus. Superior pharyngeal bones subequal, continuous.

One family, the *Gymnotidæ*, which approaches the eel-like *Siluridæ*, the *Sternopygidæ*, and the *Monopterus* of Java, so as to be in a measure intermediate between them. The characters are, no parietal fontanelle; four superior pharyngeals, three basal branchiylals; brain prolonged between orbits. The structure of the fins, and the rudimental maxillary bones distinguish this family from the *Sternopygidæ*, with which they have been heretofore associated. In the first they are like the eels, in the latter the siluroids.

ICHTHYOCEPHALI. Epiclavicle suspended to posttemporal and to cranium; mouth bounded above by premaxillaries, which are in contact on the median line, and in contact with a distinct maxillary by the posterior margin; no interneural spines, pectoral fins nor symplectic bone; two basal branchiylal pairs. Vertebræ unaltered. Two pairs basiylals.

One family, the *Monopteridæ*. Two (3d and 4th) superior pharyngeal bones on each side. The general form is eel-like.

HOLOSTOMI. Epiclavicle suspended to fourth vertebra, posttemporal wanting. Parietals in contact. Mouth bounded by the premaxillaries which are in contact medially and bounded behind by maxillary. Symplectic present; vertebræ unaltered; no pectoral fin. Third superior pharyngeal not smaller than fourth.

One family, the *Symbranchidæ*, with the genera *Amphipnous* and *Symbranchus*.

ENCHELYCEPHALI. Parietals in contact; lower pair of basiylals wanting. Scapular arch suspended to an anterior vertebra, no posttemporal, no symplectic, maxillary bone absent or connate with premaxillary which forms border of mouth. Premaxillaries separated on the median line by the ethmoid. Superior branchiylals and inferior and superior pharyngeals well developed; the latter of three bones. Of these the fourth is largest and supports the third, which with the second is directed forwards.

1. Palatopterygoid arch complete; pectoral fins.

2. Pectoral fins; palatopterygoid arch represented by pterygoid; premaxillaries more widely separated.

Congridæ.

Anguillidæ.

3. No pectoral fins ; no metapterygoid ; pterygoid a slender rod ; ethmoid much wider. *Gymnothoracidae*.

COLOCEPHALI. Parietals largely in contact, opercular bones rudimental, the preoperculum generally wanting. Premaxillary rudimental or wanting ; ethmoid very wide. Symplectic, maxillary, pterygoid, basal-branchiyl, superior and inferior pharyngeal bones all wanting, except the fourth superior pharyngeal. This is jaw-like, and supported by a strong superior branchiyl ; other superior branchiyls wanting or cartilaginous.

This well marked order includes the eels of the family *Muraenidae* (with *Gymnomuraena* etc).

It is evident from the above, that the eel-like form common to the last five orders is not more important in a systematic sense, than the fish-like form, which is common to so many of the others.

PHYSOCLYSTI.

The following is an analytic synopsis of the orders. They all have the parietals entirely separated by the supra-occipital, and lack the præcoracoid, and have the symplectic present.*

A Scapula suspended to the anterior vertebræ.

Superior branchiyls and pharyngeals present, inferior distinct ; maxillary distinct ; no interclavicles.

15 OPISTHOMI.

A A Scapula suspended to cranium by a posttemporal.

I. Ventral fins abdominal.

Branchial arches well developed, the bones present, except fourth superior pharyngeal ; third much enlarged. Inferior pharyngeals distinct.

16 PERCESOCES.

Third and fourth superior pharyngeals much enlarged, inferior pharyngeals coössified.

17 SYNENTOGNATHI

Superior branchiyls and pharyngeals reduced in number ; inferiors separated

18 HEMIBRANCHII.

Superior branchiyls and pharyngeals, and basal branchiyls wanting ; gills tufted.

19 LOPHOBRANCHII.

II. Ventral fins thoracic or jugular.

First vertebra united to cranium by suture ; epiotics united behind supraoccipital ; basal pectoral radii elongate.

10 PEDICULATI.

Posterior cephalic region normal, anterior twisted so as to bring both orbits on one side ; inferior pharyngeals distinct.

21 HETEROSOMATA.

Cranium normal, premaxillaries usually coössified with the maxillaries behind, and the dentary with the articular ; pharyngeal bones distinct.

22 PLECTOGNATHI.

Cranium normal, bones of the jaws distinct ; inferior pharyngeal bones distinct.

23 PERCOMORPHI.

Cranium normal, bones of the jaws distinct ; third superior pharyngeal much enlarged, articulated with cranium, inferior pharyngeals coössified.

24 PHARYNGOGNATHI.

These orders are more fully defined below, and the families which are referable to them pointed out.

OPISTHOMI. Scapular arch suspended to the vertebral column. Superior pharyngeals and branchiyls ossified, in the former third a little larger, followed by a small fourth. Three basal branchiyls, inferior pharyngeals distinct. Maxillary bone distinct ; supraoccipital separating parietals. No interclavicles. Symplectic present.

One family the *Mastacembelidae*. In it, the tail is isocercal, spinous dorsal present, and the ventrals wanting. It bears considerable resemblance to the eels of the family *Symbranchida*.

PERCESOCES. Ventrals anteriorly or posteriorly abdominal. Mouth formed by premaxillaries ; posttemporal furcate anteriorly, not suturally attached. Three basal branchiyls : all those of the superior series generally present. Superior pharyngeals with the third very largely developed, but not articulated to the cranium. Inferior pharyngeals distinct. Basal pectoral rays four, short. Basis cranii without muscular tube, but with rudimental upper floor.

* Except in *Ostracium*, where it is not ossified.

1. Dorsal fin of branched radii; no second floor of brain case; transverse wing on inside of hyomandibular; second superior pharyngeal rod-like, first present, third simple. *Opheocephalidæ.*

2. Dorsal fin of spinous and soft portion; no hyomandibular wing; second superior pharyngeal subconic, third very large of two horizontal laminae, the superior supported by the inferior by a vertical rod. Superior branchiyls, second a triangular plate with supero-exterior process; third and fourth tri-radiate. *Mugilidæ.*

3. Dorsal fin of spinous and soft portions, ventrals more abdominal; third superior pharyngeal long and wide, simple, second rod-like. Basis cranii with upper floor better developed anteriorly. *Atherinidæ.*

The family of *Cyprinodontidæ* approaches the *Opheocephalidæ* very closely, differing as to ordinal characters, in the presence of the ductus pneumaticus. The form of the maxillary bone and anterior position of the ventral fins ally them to the *Mugilidæ*, while the enlarged third superior pharyngeal even exceeds that of the *Atherinidæ*. The physiognomy brings it into relation with this order.

SYNENTOGNATHI. Mouth bounded by the premaxillary only; parietal bone very much reduced; posttemporal slender, furcate; supraclavicle not distinct. Pectoral fin with elevated basis; no interclavicle. Superior pharyngeals second and third large, oval, not articulated to cranium, sending processes forward; fourth wanting. Inferior pharyngeals coössified. Basis cranii double in front, but without muscular tube.

The only family of this order, the *Scomberesocidæ*, has a diphyccercal tail, and no spinous dorsal fin. In its rather weak superior branchiyls it shows resemblance to the next order.

HEMIBRANCHII. Mouth bounded above by premaxillary only; posttemporal not furcate. Pectoral fins elevated; interclavicles developed. Superior pharyngeals small, weak; second, third, and generally fourth present; superior branchiyls rudimental, the fourth, and sometimes others, wanting. Inferior pharyngeals distinct. Branchial processes narrow laminae. Basis cranii simple, no tube.

1. Anterior vertebræ but little enlarged; dorsal spines strong; first, second and third superior branchiyls and second and third superior pharyngeals present. *Gasterosteidæ,*

2. Four anterior dorsal vertebræ much elongate (centrum and spine united by suture in *Fistularia*), dorsal spines very weak, or none. *Fistulariidæ.*

a Superior branchiyls cartilage, three superior pharyngeals. *Aulostoma.*

β Three anterior superior branchiyls osseous, three superior pharyngeals, directed forwards. *Fistularia.*

3. Four anterior vertebræ much elongate, with strong diapophyses, and normal articulations.

Fourth superior branchiyl and first and fourth superior pharyngeals only wanting. *Centriscidæ,*

4. Six anterior vertebræ extremely elongate, with normal articulations of centra.

Fourth superior branchiyl and all the superior pharyngeals wanting. *Amphisilidæ.*

This very natural order connects the ordinary fishes immediately with the *Lophobranchii*. The family *Gasterosteidæ* is the least specialized of them, and presents some relationship to *Nematocentris*, a genus of *Atherinidæ*, from Australia. The latter has flat, transverse and serrate spinous rays to both dorsal fins, which both exhibit soft rays, as though in anticipation of their absence anteriorly in *Gasterosteus*. The relationships of this order to the *Lophobranchs* are numerous. They are, the weakening of the branchial apparatus, the presence of the interclavicles (which I find in all), the simplicity of the posttemporal bone and basis cranii, the shortness of the branchial processes the prolongation of the muzzle and the ganoid plates, are characters of subordinate relationship. On the part of the *Lophobranchii*, the *Solenostomidæ* approach this order, but to which family I am not sure, probably to the *Fistulariidæ*.

LOPHOBRANCHII. Mouth bounded by the premaxillary above; posttemporal simple, coössified with the cranium. Basis cranii simple. Pectoral fins with elevated basis; well developed interclavicles. Anterior vertebræ modified, the diapophyses much expanded. Inferior and superior pharyngeals and superior branchiyls wanting or unossified. Branchial processes in tufts.

1. A weak spinous dorsal fin.

2. No spinous dorsal fin.

Solenostomidæ.
{ Syngnathidæ.
{ Hippocampidæ.

PEDICULATI. Basal radii of pectoral fin elongate, reduced in number ; no interclavicles. Epiotics united with each other above behind supraoccipital, and the first vertebra with the cranium by suture ; posttemporal broad, flat, simple. Superior pharyngeals two, similar, spatulate with anterior stem and transverse blade. Basis cranii simple.

Two families, the *Antennariidæ*, with three, and the *Lophiidæ* (*Lophius*, *Halieutæ*, *Malthæ*), with two, basal pectoral radii. They connect with the *Percomorphi* by the *Blenniidæ* and *Batrachidæ*.

HETEROSOMATA. Cranium posteriorly normal ; anteriorly with twisted vertex, to allow of two orbits on one side, or one vertical and one lateral ; basis not quite simple ; dorsal fin with jointed rays. Superior pharyngeals four, the third longest, much extended forward ; inferiors separate.

Embraces the family of *Pleuronectidæ*.

PLECTOGNATHI ; cranium posteriorly normal ; the posttemporal coössified with the epiotic, and undivided. The elements of the mandible and usually the premaxillary and maxillary coössified. Interoperculum a slender rod. Superior pharyngeals laminar usually vertical and transverse.

1 Maxillary distinct, a suboperculum ; sup. pharyngeals vertical, transverse, fourth present, minute ;

Triacanthidæ.

2 Maxillary coössified, a suboperculum ; basis cranii double, with tube. Pharyngeals vertical transverse, fourth wanting ;

Balistidæ.

3 Maxillary coössified, a suboperculum and symplectic ; basis cranii simple.

Pharyngeals transverse vertical, fourth present ;

Tetrodontidæ.

Do. more longitudinal,

Diodontidæ.

4 Maxillary coössified ; no suboperculum ; symplectic not ossified ; interclavicles present. Fourth sup. pharyngeal wanting, 2d and 3d forming a vertical subconic mass ;

Ostraciontidæ.

The contents of this order are heterogeneous, and it is questionable whether section fourth really belongs to it. The Plectognaths are associated with the true *perciform* fishes by *Triacanthus* on their part, and the *Acronuridæ* and *Chaetodontidæ* on the other. Their affinities have never been, in my estimation, heretofore properly expressed in the systems, where they have always been arranged at a distance from the higher *Physoclysti*. Yet the structure of the swim-bladder, skull, scapular arch, caudal vertebræ, pectoral fin, in fact, everything, combine to indicate their position to be here. The shortened jaws, especially the maxillary of *Acanthurus*, remind one of *Triacanthus*, and its closely united slender femora, approach those of *Balistes*. The coössification of the simple posttemporal with the cranium confirms the affinity.

PERCOMORPHI. Bones of the mandible distinct, maxillary distinct. Cranium symmetrical, epiotics normal ; no interclavicles ; posttemporal not coössified with cranium. Basal pectoral radii not enlarged ; humeri suspended (generally) from the scapular arch. Basal branchiyls three, inferior pharyngeals distinct ; superior pharyngeals with the third most generally largest. Sub and interoperculum present, plate-like.

This extensive order embraces a great variety of forms, some of which may yet be regarded as forming distinct orders. At present I am not sufficiently sure of their exact definition to admit them as such.

I. *Anacanthini*. Basis cranii simple, no tube ; posttemporal bifurcate, scapular foramen between scapula and coracoid. Superior pharyngeals three, horizontal, third little larger. Dorsal fin, rays flexible, jointed. Includes the families *Gadidæ* and *Macruridæ*, both with isocercal caudal vertebræ.

II. *Haplodoci*. Basis cranii simple flat, posttemporal simple undivided. Scapular foramen in centre of scapula. Basal segments of pectoral fin five, elongate. Superior pharyngeals contracted, first and fourth wanting, third basin-shaped with second adherent. Dorsal fin with some spinous rays.

One family, the

Batrachidæ,

III. *Scyphobranchii*. Basis cranii simple, no tube ; posttemporal furcate. Superior pharyngeals shortened, fourth and first generally wanting, third large, basin-shaped, second generally scale-like or coössified with third. Scapula with median foramen. Dorsal radii usually soft. Families *Uranoscopidæ*, *Gobiidæ* (genera *Gobius* *Philypnus* *Electris*

Callionymus Periophthalmus Boleophthalmus, Amblyopus Trypauchen), *Blenniidae* (*Zoarces Anarrhicas, Cryptacanthodes, Salarias, Centronotus, Cristiceps*), *Gobiesocidae* (*Gobiesox Sicyases, Lepadogaster*); *Cottidae* (*Uranidea, Cottus Leptocottus, Hemitripterus, Scorpaenichthys*).

IV. *Epelasmia*. Basis cranii double, with basal muscular tube; posttemporal undivided. Second, third and fourth superior pharyngeals transverse vertical laminæ. Scapula with median foramen; basal pectoral bones four, short. Dorsal spines strong. Families, *Acronuridae*, (with *Amphacanthus*) and *Chaetodontidae*, (with *Chaetodon, Chelmo, Zancus, Platax, Heniochus, (Taurichthys), Epibulus* and *Toxotes*).

V. *Rhegnopteri*. Basis cranii double with tube; posttemporal bifurcate; scapula with median foramen; superior pharyngeal bones four, third largest, narrow, directed forward. Basal pectoral bones divided; two normal, supporting fin; one longitudinal without rays, and one a plate on coracoid, supporting elongate rays. Dorsal spines. One family, the *Trichodontidae (Polynemidae)*.

VI. *Distegi*. Basis cranii double, with muscular tube. Posttemporal bifurcated, scapula with median foramen; basal pectorals three or four, short quadrate. Superior pharyngeal bones four, third always the largest, longitudinal, more or less elongate, not articulated to the cranium. Inferior pharyngeals separated. Dorsal fin with strong spines.

α Third extremely elongate, narrowed forwards; *Scombridae, Xiphiadidae, Trichiuridae*.

β Third shorter, but narrow; *Berycidae, Percidae* in part.

γ Third nearly wide as long; *Percidae* pt., *Sparidae, Sciaenidae, Pristipomatidae, Triglide* pt.

δ Third much enlarged into a grinder. *Sillaginidae, Carangidae* (*Scyris, Blepharis, Lactarius, Drepane, Equula, Trachinotus*), *Echeneidae, Gerreidae, Heterognathidae, Amblodon, Liostomus* (4th wanting).

ε Third more or less basin shaped; *Pterois, Synanceia, Scorpena, Pelor* (tube rudimental), *Peristedion, Trigla* (pts).

VII. *Labyrinthici*. Basis cranii double, with muscular tube. Superior pharyngeals without the fourth, third massive articulated to cranium, one or other of the superior branchiyls developed into vertical laminæ, often involutioned. Inferior pharyngeals distinct. Dorsal fin spinous.

I. Second sup. pharyngeal present, superior branchials present, fourth greatly laminated.

Osphromenidae.

II. Second sup. pharyngeal wanting; first sup. branchiyl with three laminæ.

α Second and third sup. branchiyls present. (*Polyacanthus Anabas*).

Anabantidae

β Second (and third?) sup. branchiyls wanting.

Helostoma.

PHARYNGOGNATHI. Basis cranii double, with tube; basilar bones of pectoral, four, short. Scapula with median foramen. Cranium normal posteriorly; posttemporal bifurcated. Superior branchiyls not complicated; superior pharyngeals with the third greatly developed and attached by movable articulation to cranium, the others wanting or rudimental. Inferior pharyngeals solidly coössified.

1 Fourth superior pharyngeal rudimental, second slender toothless; first similar.

Embiotocidae (7 genera).

2. Fourth wanting; second laminar, adherent to third, dentate: (probably 4th coössified with third), (3d not articulated to cranium in *Crenicichla*, first present in *Chromis* and *Heliases*).

Chromididae.

3. Fourth wanting;

* Second rudimental rod-like, third with fixed articulation to fourth sup. branchiyl.

Labridae.

** Second wanting;

Labridae, ? Crenalus, Odax, Gomphosus.

4. Third only present, the opposites united, and with a sliding articulation on the much enlarged fourth superior branchiyl.

Scaridae.

With this order we close the series, and think that it has a general claim to stand at the head of the true fishes. It displays an aggregation of all the characters which distinguish the higher from the lower fishes, whether in refer-

ence to order, sub-class, or class. The fins in their position and attachments exhibit the most remote separation from their characters in the *Crossopterygidae*. The base of the cranium is complex, and removed in construction from the simple parasphenoid floor of the lower divisions. The pharyngeal bones are more specially developed than in any other order. The elements of the support of the caudal fin are more thoroughly coössified than in any other except *Scombridae* and the *Plectognathi*.

GENERAL OBSERVATIONS.

In tracing the affinities of the *Physostomi*, I have pointed out the relation between the *Chondrostei* and the *Nematognathi*, and the *Halecomorphi* and the *Isospondyli*. The series commenced with the cat-fishes may be continued into the *Mormyri* and then to the families of the *Plectospondyli*, where the series with altered vertebræ and with ossicula auditus, terminates. The *Characins* have, however, considerable affinity to the *Isospondyli*, especially in the type of their branchial bones. From the latter group we pass to the *Haplomi*, and thence to the *Physoclyst* groups. The eel-like groups form a special line. The *Glanencheli* have cranial characters of the orders with modified vertebræ, (*Nematognathi* and *Plectospondyli*,) with fins of the more typical eels. The latter show a steady approach in some points to the conditions characterizing the *Chondrostei*. The loss of the maxillary, of opercular bones, and of pharyngeal elements, reminds one of these, but in the loss of the premaxillary, and great development of the ethmoid in the *Colocephali*, we have features quite unique. The vertebral position of the scapular arch is the only shark character they possess: while, on the other hand, the *Holostomi* are undoubtedly related to the *Mastacembelus*, a real *Physoclyst* with spinous dorsal fin. These relations are as yet entirely inexplicable.

The affinities among *Physoclysti* are more clear. Omitting the genus above mentioned, we find the four orders with ventral fins to form a true series, with a *Synentognath* variation, terminating in the greatly degraded order of *Lophobranchii*. The *Percesoces* give us our nearest connection with the groups with ventral abdominals, and lead at once to the *Percomorphi*. From this centre radiate many lines of affinity. One leads from the *Chaetodontidae* through the *Acronouridae* to the *Plectognathi* by the similarity in the arrangement of the posttemporal and forms of the pharyngeal apparatus. An important division of the *Percomorphi* has the basis cranii simple and the branchial arches reduced above, viz: the *Scyphobranchii*. The *Cottidae* are the most generalized family of the group, and lead on the one hand, to the *Triglidae* of the *Distegi*, with which they are generally arranged,—and on the other, to the *Blenniidae*. Some of the latter elongate the basal pectoral bones considerably, and lead to the *Batrachidae* on the one side, where the number of these bones is increased, and on the other to the *Pediculati*, where the number is diminished. To these groups the *Anacanthini* and *Heterosomata* are also allied.

The third upper pharyngeal bone has already presented an increase of mass and use in the first orders of *Physoclysti* with the ventral fins. Among the *Percomorphi*, the same increase makes its appearance by little beginnings in some *Sciaenidae*. It is quite noteworthy in most of the *Carangidae*, a group whose separation from the *Scombridae* by Gill, is supported by this part of their organism. Through forms not now specified, approach to the *Pharyngognathi* is made. Here the pharyngeals are modified into a mill-like structure, which is least specialized in the *Embiotocidae*, and most so in the *Scaridae*.

NAMES OF THE ORDERS.

Of the orders here proposed or adopted, a number have been employed in various senses by ichthyologists. I refer only to those who have defined their groups, as those who have merely given names cannot be understood as authors of anything but those names. A definite idea of the definition of a group involves the ability to characterize it, and by such process only can the idea entertained by the author of a division be determined by others.

The order *Nematognathi* was named and defined by Prof. Gill in 1861;* Prof. Agassiz has expressed his belief that the order was well established. Additions to its characters are now made. The *Synentognathi* was also proposed in 1859† as distinct from the *Pharyngognathi*, with which J. Müller had united it. The order of *Lophobranchii* is

* Proceed. Acad. Nat. Sciences, Philadelphia, in a "Catalogue of the Fishes of the Eastern Coast of North America."

† Loc. Cit. p. 148.

well known as Cuvier's, and has been generally adopted. Müller proposed the *Pediculati* with part of the definition here given. The *Heterosomata* were arranged together under this name and defined by Dumeril. The *Plectognathi* were first defined by Cuvier; while the *Pharyngognathi* a part only of Müller's order of that name, was defined by Gill, after the deduction of the *Synentognathi*.

II. CATALOGUE OF SPECIES.

PHARYNGOGNATHI.

Pomacentridæ.

MICROSPATHODON CHRYSURUS, Cuv. Val. V., 476, *Microspathodon*, Gthr.

St. Croix, Dr. Griffith; St. Martins, Dr. Rijgersma.

GLYPHIDODON SAXATILIS, Linn., Cuv. Val. V., 446, Gthr., Catal. B. M., iv., 35.

St. Martins, Dr. Rijgersma; St. Croix, Thos. Davidson, Dr. R. E. Griffith; New Providence, Dr. Wood.

POMACENTRUS LEUCOSTICTUS, Müll. Trosch. in Schomburgk's Nat. Hist., Barbadoes, 674. Günther Catal. B. Mus. iv., 31.

St. Croix, Capt. T. Davidson; St. Martins, Dr. Rijgersma; New Providence, Dr. Wood.

Gerridæ.

GERRES GULA, C. V., vi., 464. Günther Cat. B. M. II., 346.

St. Martins, Dr. R. E. van Rijgersma; St. Croix, Thos. Davidson, Dr. R. E. Griffith.

Scaridæ.

SCARUS GUACAMAIA, Cuv. Val. XIV., 178. *Pseudoscarus*, Günther Cat. Brit. Mus. iv., 233.

St. Martins, Dr. Rijgersma.

SCARUS CHLORIS, Bloch Schn., *Pseudoscarus*, Günther Catal. iv., 227.

New Providence, Bahamas, Dr. H. C. Wood.

SCARUS SANCTÆCRUCIS, Bloch., *Pseudoscarus*, Günther Catal. iv., 226. *Scarus alternans* C. V., xiv., 200.

St. Croix, Dr. R. E. Griffith.

SCARUS TAENIOPTERUS, Desmarest, Cuv. Val. XIV., 195, *Pseudoscarus* Gthr. Catal., IV., 226.

Santa Cruz, R. E. Griffith, M. D.

SCARUS DIADEMA, Cuv. Val. XIV., 146. Poey Rep. Cuba ii., p. 347. Guichenot Catal. Scari Mus. Paris, Proc. Cherbourg.

This species, placed as a synonyme of the last with question, by Günther in the Catal. Brit. Mus. iv., p. 226, is as distinct from it as the allied species are from each other. A fresh specimen from Dr. Rijgersma enables me to describe the colors of this very handsome fish as follows:

General color of anterior half of the body, crimson; of the posterior, golden. All the scales with a red-orange border. An orange band from mouth to orbit, margined by green above and below, the lower continued to opercular lobe and round chin behind a red band. Temple greenish; golden of posterior parts continued as a band to the base of the pectoral. Caudal slightly rounded, the angles not prolonged, the superior and inferior margins green. Dorsal and anal fins, with dirty green margins, yellow-edged within, and very narrow green basis with inner yellow margin. Numerous transparent, dirty green spots on intermediate space of anal and posterior two-thirds of dorsal. Six rows of scales on the middle series of the cheek.

When the specimens are bleached in spirits, the species is best distinguished from the *P. taeniopterus* by the spotted fins, as well as the lack of dark lateral band, and six cheek scales.

St. Martins, Rijgersma; St. Croix, Davidson and Griffith.

SCARUS PSITTACUS, Linn., *Pseudoscarus*, Günther Catal. 225. *Scarus vetula*, Bloch, Cuv. Val. XIV., 193.

St. Martins, Rijgersma; St. Croix Dr. Griffith.

SCARUS AUROFRENATUS, Cuv., Vol. XIV., 191. Gthr. Cat., iv., 212.

St. Croix, Dr. Griffith; St. Martins, Dr. Rijgersma.

SCARUS CHRYSOPTERUS, Bl. Schn. Cuv. Val. XIV., 185. Gthr. Catal. IV. 211.

St. Croix, Dr. Griffith; St. Kitts, B. H. Lightfoot.

SCARUS RADIANUS, "Cuv. Val." Günther Cat., B. Mus., iv., 211.

Several specimens which agree with Günther's description, but not with any of Prof. Poey's.

St. Martins, Dr. Rijgersma.

SCARUS HOPILOMYSTAX, Cope Sp. nov.

This species agrees with the description given by Günther of what he considers to be the young of the last species. It is clearly not the young of *S. radians*, nor of any of the species described by Günther or Poey. It is nearly allied to the *S. lachrymosus* and *S. atomarius* of Poey, (Repert. Fis., etc., Cuba. II., 343,) in having prominent divergent acute teeth external to the confluent series of the upper jaw. This character is evanescent in *S. chrysopterus* and *S. abildgaardii* as indicated by our specimens, but would indicate another genus were it constant. Our specimens of *S. radians* (above) are of the same size as those of the present species, and display no trace of external teeth, five of the former being compared with the latter. The *S. radians* display the caudal fin openly emarginate, the *S. hoplomystax* rounded. In the former, there are obscure cross-bands with scattered red scales, in the latter a broad longitudinal band, with red below it. This band extends from the orbit to near the caudal fin including two and two half rows of scales. There are four equidistant pale spots in its course, a silvery band round the chin. Three brown spots on the dorsal fin; other parts of that and the caudal punctate with white and brownish, a row of small white dots on pectoral, round the basis. Anal fin with white variations and three vertical brown spots, four in some,—obscure in others. A very faint spot at the base of the pectoral, wanting in some; it is quite distinct in *S. radians*.

Orbit, five times in head, nearly twice in muzzle; depth, 3 2 times in total length; head, four times. Free teeth, three on each side, the anterior directed to the opposite, the posterior outwards to the same side; the latter quite long and sharp. Marginal teeth, very minute, those of the mandible larger, three rows with crowns nearly distinct. Length, five inches.

St. Martins, Dr. R. E. van Rijgersma.

This species differs from the *S. lachrymosus* of Poey in having six instead of four free maxillary teeth, and nine soft anal radii. The color must be quite different, as Poey mentions none of the peculiarities of this fish, and says there is a blue band from the orbit to the lip, which I have not seen in it. In *S. atomarius* the orbit enters a little over four times the length of the head, and the caudal is vertical, not rounded. The coloration, from Prof. Poey's description is quite different; he connects also one more anal ray, but he may include the posterior half of the last.

St. Martins, Dr. Rijgersma. Many specimens.

SCARUS RUBRIPINNIS, Cuv. Val. XIV., 199.

St. Croix, Dr. Griffith, (six inches long.)

SCARUS ABILDGAARDII, Bloch. Cuv. Val. XIV., 175; Günther, IV., 210.

New Providence, Bahamas, Dr. Wood; St. Martins, Dr. Rijgersma; St. Croix, Dr. Griffith.

SCARUS, sp. indet.

St. Croix, Dr. Griffith.

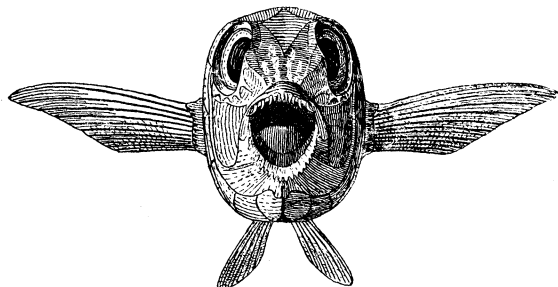
CRYPTOTOMUS ROSEUS, Cope, gen. et. sp. nov.

Char. gen. Interior series of teeth in both jaws consolidated into a single cutting body on each side, the exterior series entirely free in front, wanting on the sides. Spinous Rays, D. XI. A. III.; the dorsal flexible, terminating in filaments, and united by membrane at the base only. One row of scales on each cheek. Lips, double at the sides only.

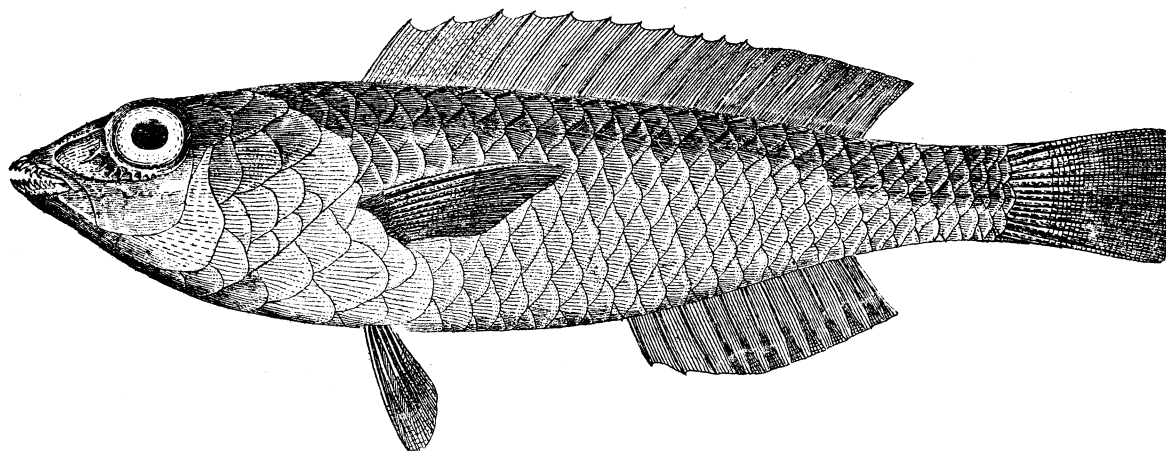
This genus has the dentition of *Callyodon* with the numerous dorsal and anal spines of the group of *Harpe*. The pharyngeal teeth are identical with those of *Callyodon*.

Char. specif., scales $1\frac{1}{2}$ —23—6; radii D. XI. 8; A. III. 8., p. 12. The ventrals are short, extending half-way to the vent; the pectorals extend three-quarters the same distance; caudal truncate. One large scale between pectoral and ventral; scales of opercles, very large; preopercular limbs, naked; cheek with a series of three scales, which are caducous.

General form like that of *Julis*, elongate; depth into total length, four and a half times; length of head into the same, three and one-third times. The extremity of the maxillary bone in its sheath does not quite reach the anterior line of the orbit. The free teeth are closely appressed to the solid mass beneath and are included in two alternating rows anteriorly.



1 a


 Fig. 1. *Cryptotomus roseus*, Cope.

They all project in the line of the front and of the mandible, the superior overlapping a little the inferior. The diameter of the eye enters the length of the head including teeth, five times; the muzzle 1 4-5 times, and the inter-orbital space .75 of a time. The front is flat, and the muzzle sufficiently so to produce a slight canthus rostralis. Its profile descends gradually straight to the teeth.

The color is rosy purple, most purple on the cheeks; below, fading into light orange. Scales of the superior row, brown bordered. Caudal fin, yellow.

St. Martins, D. R. E. van Rijgersma.

Labridæ.

COSSYPHUS RUFUS, Linn, Günth., catal. B. M. IV., 108, *C. bodianus*, Cuv. Val. XII., p. 103.

New Providence, H. C. Wood, M. D. St. Croix, Dr. R. E. Griffith.

CLEPTICUS GENIZARRA, Cuv. Val. XIII, 267. St. Croix, Dr. Griffith.

PLATYGLOSSUS BIVITTATUS, Bloch., Günth., Catal IV., 164. *P. psittaculus*, C. V. XIII., 387.

St. Martins, Dr. Rijgersma.

PLATYGLOSSUS INTERNASALIS, Poey, Mem. Cuba II., 421. Günth. l. c., IV., 164.

St. Martins, Dr. Rijgersma.

PLATYGLOSSUS CROTAPHUS, Cuv. Val. XII., 395. Gth. l. c., 163.

St. Croix, Capt. Davidson.

PLATYGLOSSUS RUPTUS, Poey, Mem., Cuba, II., 212. Günther, l. c. IV., 162.

St. Croix, Dr. Griffith and Capt. Davidson.

PLATYGLOSSUS CYANOSTIGMA, Cuv. Vol. XIII., 391. Gth. l. c. IV., 161.

St. Croix, Dr. Griffith.

LACHNOLAEMUS FALCATUS, Linn. (Labrus). Günther Cat. Brit. Mus. IV., 87. *L. aigula*, Cuv. Val. XIII., 277. Lub. 378.

New Providence, D. H. C. Wood.

Malacanthidae.

MALACANTHUS PLUMIERI, Bloch., Cuv., Vol. XIII., 319. Tab., 380. Günther Catal. III., 359.

St. Croix, Dr. R. E. Griffith.

PERCOMORPHI.

Distegi

Berycidae.

RHINOBERYX CHRYSEUS, Cope Sp. Nov.

In this fish, the muzzle projects a very short distance in advance of the premaxillary border, and is therefore referred to the same genus as the *Rhynchichthys brachyrhynchus* of Bleeker, as proposed by Gill, though without entire confidence, as I have not seen the latter species.

The premaxillary groove open in *Myriopristis*, is here over-roofed and closed by the extension of the bones of the front; the spines of the premaxillaries are very short. On the vertex is a short supraoccipital corona. In front of and on each side of this, two approximated crests rise, which extend to the end of the muzzle. They enclose a groove which is narrower and deeper on the anterior half the cranium. External to these, a low ridge extends from each pterotic region, parallel to the other. Above the posterior border of the pupil they diverge to the front margin of the orbit and then converge to the end of the muzzle. A bony thickening on each side marks the union of these ridges with the median. From this a strong ridge extends along the posterior margin of the preorbital bone, enclosing

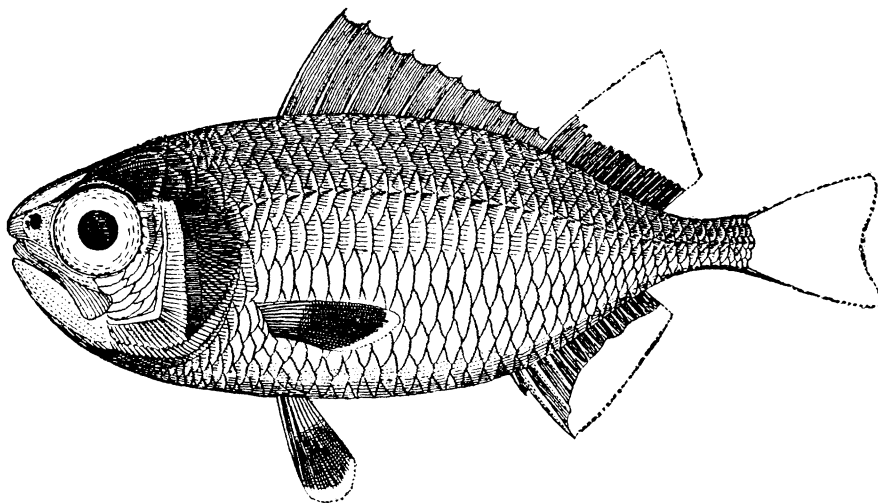


Fig. 2. *Rhinoberyx chryseus*, Cope.

in the angle with the lateral, the nares. Its edge is serrate, as is also that of another high crest on its front edge. Post frontal region, ridged; four teeth on posterior rim of orbit. Preoperculum, serrate coarsely behind and below, with rudimental spine at angle. Interoperculum, suboperculum, and operculum serrate, the latter with one submedian spine. Clavicle, epiclavicle and "posttemporal" toothed. Eye 2.6 times, interorbital width 3 times, in length of head. Last 3.2 times in length to basis of caudal; depth in same 2.75 times. Scales 3—38—7. Fin rays D. XI. 14; A. IV. 13; V. I. 7. Caudal peduncle, very short and slender. Last dorsal spines, short; second, elongate,

exceeding the others, and equalling width of operculum and orbit to pupil. Length 2.5 inches. The color is golden excepting the superior three rows of scales and the posterior half the vertex, which are reddish. Spinous dorsal membrane with bright pigment (? red). Two specimens from St. Croix from Thos. Davidson.

MYRIPRISTIS JACOBUS, Cuv. Vol. III., 162. Günther Catal. I. 19.

St. Martins, (?) R. E. van Rijgersma, M. D.; St. Croix, Dr. R. E. Griffith.

HOLOCENTRUM SICCIFERUM, Cope, sp. nov.

Depth 2.6 times in length, exclusive of caudal fin; length of head (with spines) 2.75 in same; eye 2.6 times in head and .75 in interorbital width. Radii D. $\times 1$, 13; A. IV., 9. Scales 3—45—8. Spinous dorsal rather short, elevated; last spine very short, only connected with first soft ray within the groove. Second dorsal not elevated, first rays equal 1.25 longest spines. Third anal ray not reaching basis of caudal: scales bordering anal fin, prolonged into grooved blades; body scales strongly pectinate not grooved. The muzzle is contracted especially laterally, the maxillary reaching the anterior margin of the pupil. Anterior supernumerary maxillary minute. Operculum finely denticulated, opercular spines two, equal, elongate; a pair of smaller spines at summit of operculum. One spine directed backwards at front of preorbital bone, all the lateral bones serrate. Interorbital carinae very weak. Ventral fins not reaching vent. Length 2.75 inches.

Color in spirits silvery. A brown longitudinal band between each two rows of scales, to middle of sides; below this, brown punctae in the same position. Head brown shaded. Fins white, except first dorsal which is blackish; the membranes from I. to III. spines black with white or pale spots at base and one at margin. Chin brown.

New Providence, Bahamas, Dr. H. C. Wood.

This species, differs in many points from *H. longipinne* of the same size, viz: the wider interorbital space, narrower muzzle, upper pair of opercular spines, free opercular serration, deeper body, color, etc. It differs in coloration from the species described by Poey, who also does not mention any of the peculiarities of this fish in any of them.

HOLOCENTRUM LONGIPINNE, Cuv. Val. III., 185. *H. matejuelo* Bloch., Poey, Synopsis, 366.

St. Croix, R. E. Griffith, M. D., Capt. Davidson; St. Martins, Dr. R. E. Rijgersma; New Providence, Dr. H. C. Wood.

Percidæ.

APOGON STELLATUS, Cope. *Apogonichthys stellatus*, Cope, Transac. Amer. Philos. Society, 1866, 400.

New Providence, W. I., Dr. H. C. Wood.

BRACHYRHINUS CREOLUS, Cuv. Val. II., 265. Güthr. Catal. B. M., 100. Poey, Synopsis, 363.

St. Croix, Dr. R. E. Griffith, Capt. Thos. Davidson.

TRISOTROPIS UNDULOSUS, Cuv. Val. II., 143. Gthr. Catal. 143. Perhaps rather the *T. cardinalis* of Poey.

St. Martins, Rijgersma. St. Croix, R. E. Griffith.

EPINEPHELUS LUNULATUS, Bloch, Steindachner Verhand. Bot. Zool. Ges. Wien, 1866, 15 Tab. XIV. f. t.

St. Martins, Dr. Rijgersma; St. Kitts, Benj. H. Lightfoot; New Providence, H. C. Wood, M. D.

EPINEPHELUS CHALINIUS, Cope, sp. nov.

D. XI. 16. A. III. 10; pectorals attaining vent, caudal regularly rounded. Dorsal spines graduated, not elongate; membrane of both dorsals covered with small scales .66 to .75, its extent. Two opercular spines, the upper quite weak. Preoperculum with straight posterior margin, which is finely and sharply serrate: angle with five larger spines. Eye 4.25 times in head; head 3.5 in total (with caudal). Chin prominent. Mandible, pre and interorbital region with minute scales; maxillary bone scaleless; scales of operculum twice as large as those of cheek. Scales sharply ctenoid, 19 rows above lateral line at fourth dorsal spine.

Chocolate brown, paler below; below the lateral line six irregular undulate longitudinal darker lines, which are interrupted on the belly, and more or less confluent on the caudal peduncle. Above the lateral line these marks are

broader and more confluent. The paired fins blackish, 1st dorsal with pale base, soft dorsal with dark bordered, large pale spots at base. Three dark bands radiate from orbit to opercular margin, the middle one bifurcating. A similar band from preorbital across cheek. Throat unspotted.

St. Martins, Dr. R. E. van Rijgersma.

EPINEPHELUS STRIATUS, Bloch.

New Providence, Bahama Is. ; St. Croix, Dr. R. E. Griffith.

EPINEPHELUS ORDINATUS, Cope, sp. nov.

Radii D. XI. 16. A. III. 8. Dorsal spines subequal. Caudal fin rounded ; pectorals and ventrals subequal, extending a little beyond vent. Eye 4.25 times in length of head. Head 3.5 in total length ; depth not quite four times in the same. Preoperculum with convex, sharply serrated margin, and three coarser teeth at the angle. Three opercular spines, the superior obsolete. Scales on mandible and muzzle. Twelve rows above lateral line at V dorsal spine. Length six inches.

Brown, two darker subquadrate spots at origin dorsal fin, the first marking four interspaces, commencing at R. III; the second measuring three, commencing at D. IX. A black spot across caudal peduncle above, as in *S. striatus*. A large yellow or red spot between the dorsal spots and one behind the second, and three rows of the same on the sides. The upper row of two, large and distant ; second, of three smaller ; the third, of six or seven ; smaller still, and near the belly. A similar spot behind upper angle of pectoral and several on head and jaws. The paired fins with broad dark margin ; caudal and anal with narrow light margin outside of this.

From Panama. Found by Dr. W. S. W. Ruschenberger, Prest. Academy Natural Sciences.*

This species appears to be allied to the *S. niveatus*, Cuv. Val.

SERRANUS CORONATUS. Cuv. Val. II., 371. Gthr. Catal. B. M., 124.

St. Croix, R. E. Griffith ; New Providence, Bahamas, H. C. Wood, M. D.

SERRANUS OUATALIBI. Cuv. Val. II., 381. Gthr. Catal. B. M., 120.

New Providence, H. C. Wood ; St. Kitts, B. H. Lightfoot ; St. Croix, R. E. Griffith and Capt. Thos. Davidson.

SERRANUS GUATIVERE. Cuv. Val. II., 384. Poey, Synopsis, Pisc. Cub., 364.

New Providence, H. C. Wood, M. D.

PLECTROPOMA CHLORURUM. C. V.

St. Croix, Thos. Davidson and Dr. R. E. Griffith.

PLECTROPOMA GUTTAYARIUM. Poey. *P. melanorhina*, Guich. Sagra's Cuba., I. f. 1.

St. Croix, Dr. R. E. Griffith.

PLECTROPOMA CROCOTA. Cope, sp. nov.

Form gibbous ; depth 2.2 in length without caudal ; length of head three times in same. Eye 3.5 times in head. (including spine) 5.4ths of interorbital width. Anterior rays of soft dorsal little more elevated than last rays of spinous fin. Radii D. X. 15. A. III. 7. Ventrals to anal ; pectoral to first soft ray of anal ; caudal moderately emarginate.

Front concave in profile ; muzzle a little longer than an orbits diameter. Eight equal teeth on the lower limb of the preoperculum. End of maxillary to line of posterior margin of pupil. Scales 12—81—32. Length 4.5 inches.

**EPINEPHELUS BRACHYSOMA*. Cope, sp. nov.

Radii D. XI. 15. A. III. 8. Preoperculum slightly convex, with two short coarse teeth at angle. Three opercular spines well developed. Dorsal spines long ; fourth (longest) nearly equal muzzle and orbit. Eye 5.25 in head ; head 3.33 times in total length. Depth body 3.5 times in same. Two scales on mandibles and maxillæ ; minute ones on preorbital alone. Rows above lateral line, 15. Caudal fin gently convex ; pectoral and ventral equal, reaching vent. Length, eight inches.

Color in alcohol pale reddish brown, with numerous pale, (probably red in life) spots on the middle and lower parts of the sides, which are half to quarter as large as the pupil. A blackish band from preorbital bone above maxillary to the end of the latter. Just below its extremity a white (red) band extends in the same line to the interoperculum. No other marks on the head. All the fins except first dorsal broadly blackish bordered ; the latter narrowly bordered by the same. The ventral membrane contains a pigment probably brilliant in life.

Rio Janeiro, Brazil. Dr. W. S. W. Ruschenberger's collection.

The species is not unlike the *S. dichropterus* in characters, but it has the ray formula XI. 17.

Color saffron yellow, becoming orange on the caudal, anal and vertical fins. Dorsal region becoming brownish anteriorly. A narrow blue band from front of orbit posteriorly on cheek, and some small blue spots on side of muzzle; a narrow blue line along upper edge of preoperculum; two faint vertical lines, on perculum. Dorsal and opectoral fins and jaws saffron yellow.

This brilliant species was found it at St. Martins, W. I. by Dr. R. E. van Rijgersma.

ALPHESTES MONACANTHUS. Mull. Trosch.

Plectropoma, Gthr., Catal I. 164. *Prospinnus chloropterus*, Poey, Synopsis, 364, *Pristipoma chloropterus*, Cuv., Val. *Alphestes afer*, Bloch, Fide, Peters.

St. Martins, Dr. R. E. van Rijgersma.

RHYPTICUS SAPONACEUS, C. Val., Gill, Proc. A. N. Sci., Phil., 1861, 52.

St. Croix, Dr. R. E. Griffith.

ELEUTHERACTIS CORIACEUS. Cope, *gen. et sp. nov.*

Char. Gen. Subfam. Rhypticinæ. Dorsal fins entirely separate, dorsal with three spines, anal with none.

In the species, which is the type of this genus, the dorsal fins are far more distinct than in the *Promicropterus maculatus*, and the membrane between the dorsal spines is very low. As no species with III spines presents such a

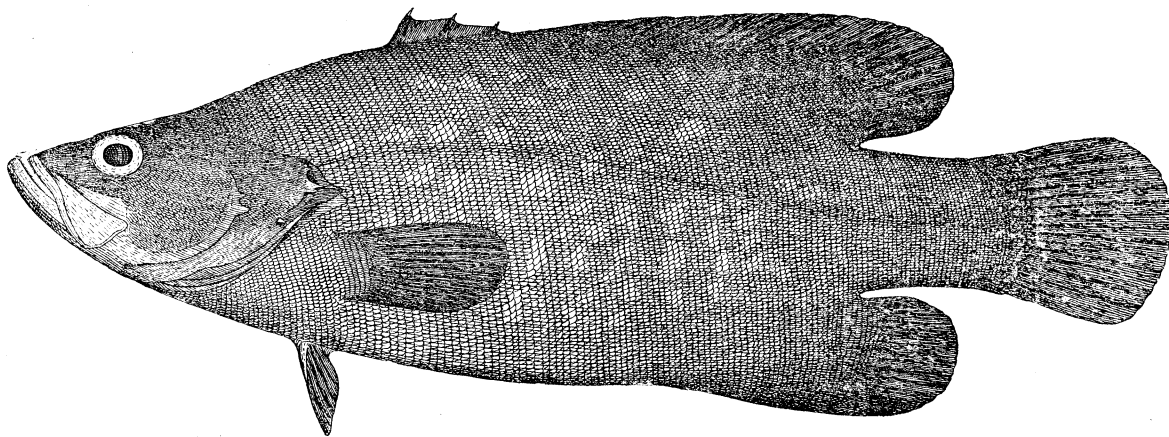


FIG. 3. *Eleutheractis coriaceus*. Cope.

separation, and it is doubtful whether those possessed of two have not the dorsals more or less confluent, I have regarded this group as distinct from either.

The allied species, *P. decoratus*, Gill, besides differing much from the *P. maculatus*, in color, has as complete a connection between the two dorsal fins as in *R. arenatus*. This connection is not wanting in a specimen of *P. maculatus*, presented to the Acad. Natural Sciences by Dr. Holbrook; so that the separation of the fins, originally assigned by Gill, as the character of his *Promicropterus*, falls to the ground. This appears to be the opinion of Gill, also, since in his last useful synopsis of the group,* he transfers *P. nigripinnis*, Gill, with united fins, to it, on account of the II dorsal spines.

Char. Specif. Lateral line very slightly elevated in front; twenty-one rows of scales between its convexity and the basis of the first dorsal ray. Greatest depth 3.33 times in length, including caudal fin. Head narrowed to the muzzle; front concave; eye anterior; chin very prominent. Eye 5.5 times in length from premaxillary border to end of opercular spine; 1.1 times in muzzle. Posterior angle maxillary, barely to posterior line of eye, posteriorly. Radii D., III., 25; A., 15; P., 16; V., I., 5. Extremities of 2 D. and A. extending to the basis of the caudal fin. Caudal rounded. Pectoral fin expands to a width equal to the length. Second dorsal originating opposite to the end of the pectoral. Scales, l. tr., + 19 — 43.

* Proceed. A. N. Sci., Phil., 1863, 163.

Color dark reddish brown; distal halves of the fins, except ventrals, black, with narrow yellow margin. Thorax, chin, and jaws brown punctate. Sides with irregular pale brown spots, not extending on fins and belly. Dorsal region and head immaculate.

Length ten inches. The two opercular, and one preopercular spines, bifid on one side.

From St. Martins, W. I. Discovered by R. E. van Rijgersma, M. D., among other interesting Zoological materials.

In determining this species I have had recourse chiefly to the published investigations of Gill, as he has developed this group more fully than any other zoologist.

ELASTOMA MACROPHTHALMUM, Müll. Trosch. *Centropristis*, M. T. *Anthias*, Günther.

St Kitts, B. F. Lightfoot.

PRIACANTHUS MACROPHTHALMUS, Cuv. Val. III, 97; Günther Cat., B. M. V. I, 215.

St. Croix, R. E. Griffith, M. D.

Sparidae.

OCYURUS CHRYSURUS, Bloch, *Mesoprion chrysurus* Auctorum. *Ocyurus*, Gill.

St. Martins, Dr. Rijgersma; New Providence, Dr. Wood; St. Croix, Dr. R. E. Griffith, Capt. Thos. Davidson.

OCYURUS RIJGERSMAEI, Cope, sp. nov.

A large species, especially notable for the elevated carination of its front, and the elongate lobes of the caudal fin.

Length of head less than depth of body, entering 4.5 times the total length. Depth at orbit equal length to preoperculum; eye 5.66 times in length of head—nearly twice in muzzle. A section of the front would be parabolic, as

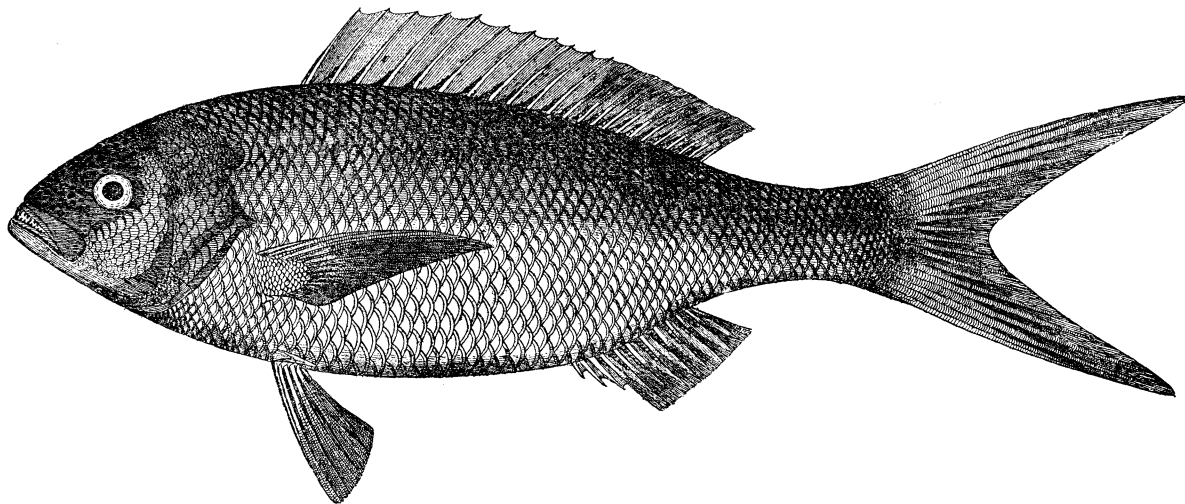


FIG. 4. *Ocyurus rijgersmaei*. Cope.

in *Coryphaena*; its elevation above the eye is equal to one eye's diameter. The extremity of the maxillary bone does not attain the line of anterior margin of the orbit. Maxillary scaleless; cheek with five rows. Preoperculum distinctly openly emarginate. Depth of body, one-fourth total length; it is 2.66 times the depth of the caudal peduncle, which is thus slender. Scales large, 6—49—15 to anus. Caudal deeply forked; the forks lanceolate; the superior longer; both scaled to near the extremity; its length (to base of superior marginal ray enters the total length 3.3 times. Dorsal and anal fins scaleless, radii; D. XII, 12; A. III, 9; C. 2.18.2., P. 14. Pectorals falcate, reaching vent; ventrals three-fourths as long.

Three short canines on each side; vomerine patch anchor-shaped; an oval patch on the tongue. Serration of preoperculum obsolete, except on angle.

Total length, 0m·53; to orbit, 0m·039; to end of opercular bone, 0m·105; to basis of pectoral (line), 0m·11; to line of first dorsal, 0m·117; to origin of second dorsal, 0m·23; to origin of anal, 0m·242; to end of second dorsal 0m·293; to fork of caudal, 0m·424.

Color in life bright red, with a broad purplish brown band from the end of the muzzle, through the orbit to the caudal fin, occupying at first 1.5 rows of scales, and finally the upper half of the caudal peduncle to the end of the basis of the second dorsal. Six dark bands, formed by lines with intervals of ground color, extend from above the lateral line to the dorsal fin, the posterior too transverse, the anterior more oblique. They are more distinct at the base, where they form open spots. A large blotch of the same above the axilla. The top of the head to the end of the muzzle and the sides above the opercula are spotted with the same. In life, this color was brilliant—probably brownish purple; but my attention having been withdrawn from the specimen, the action of spirits has injured it, and I cannot recall the exact tint.

From St. Kitts, from the collections of Benjamin H. Lightfoot.

This is a large and magnificent fish, and apparently nearly affined to the *O. chrysurus*. It has a similarly graceful form, but exceeds it in the length of the tail and slenderness of the peduncle (the former is 4.33 times in the length in the latter). It differs in many other details, and in color. Among the former may be mentioned the shorter muzzle, smaller eye, high frontal keel, and more oblique mouth. The scales are less numerous, and the dorsal spines more so. It differs in much the same way from the two allied species described by Poey, *O. ambiguus* and *O. elegans*.

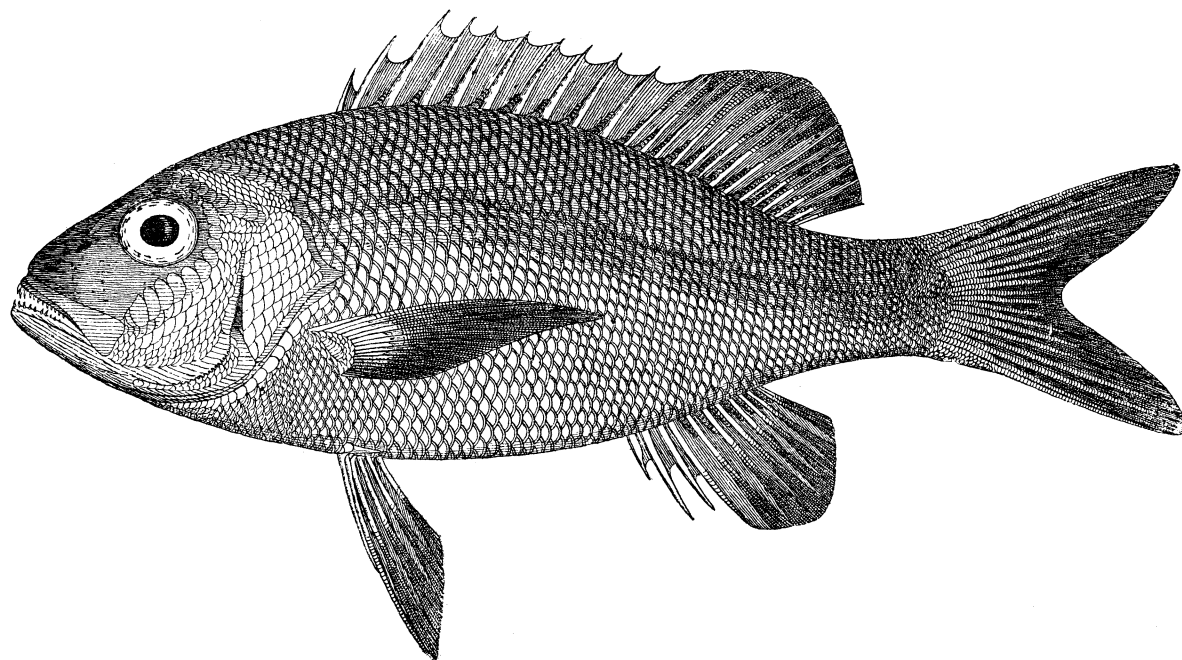


FIG. 5. *Ocyurus torridus*. Cope.

LUTJANUS TORRIDUS, Cope, sp. nov.

Radii, D, X. 13; A. III. 8. Scales, 7—46—20. Form stout; dorsal region gibbous; depth into length without caudal, 2.66 times. D. IV and V longest; soft rays gradually lengthening; emargination slight; last soft rays of D and A short. Caudal emarginate to one-third its depth, with narrow acute lobes. Pectorals and anals falcate; the former to anal fin, the latter to vent. Muzzle moderate; eye large, four times in length head. No opercular

spines; opercular and cheek scales equal. Preoperculum strongly serrate behind and half way below, with open margination posteriorly. Occipital crest very high, continued with supraorbital crests to front line of orbits. Pre-maxillary bone with three canines and a row of large teeth externally on each side; denting with several equal large teeth, anteriorly and medially. End of maxillary marking anterior third of orbit, not scaled. Total length, fourteen inches.

Color, a uniform bright crimson, a narrow sienna brown margin to the caudal fin, and line of similar color along the base of the dorsal on the second row of scales. The first is blackish in alcohol, the second much faded.

This very handsome species is like the *Anthias macrophthalmus* in external appearance, but may be soon distinguished. It attains some size.

From St. Kitts, C. H. Lightfoot.

LUTJANUS UNINOTATUS, Cuv. Val. II., 479; Günther I, 202; Poey, Synopsis, 365.

St. Martins, Dr. R. E. van Rijgersma.

LUTIANUS VIVANUS, Cuv. Val.; Gthr. I, 203.

New Providence, Bahama Is., H. C. Wood, M. D.; St. Croix, Dr. R. E. Griffith.

LUTJANUS ARNILLUS, Poey, Memorias II., 154; *Apsilus dentatus*, Guichenot, in De la Sagra's Cuba 160, Tab., I, f. 1.

St. Croix, Dr. R. E. Griffith.

LUTJANUS GRISEUS, Cuv. Val.; Poey; Gthr. I., 194.

St. Kitts, B. H. Lightfoot; St. Croix, Dr. R. E. Griffith.

LUTJANUS BRACHYPTERUS, Cope sp. nov.

Scales smaller, 8—57—16. Radial formula D X. 12; A, III, 8; muzzle intermediate in relative length; the pre-orbital bone wide. One only moderately strong canine tooth on each side. Eye four times in length of head, equal inter-orbital width. Extremity of maxillary reaching beyond line of anterior margin of pupil. Profile straight not concave. Preoperculum with a wide open emargination, above which it is minutely below, coarsely serrate; inter-opercular, knob distinct. Cheek with the posterior—inferior half scaled; maxillary smooth. Third and fourth dorsal spines longest; equal muzzle to orbit. Pectorals reaching little beyond vent; ventrals not reaching vent; D, 2, and A not reaching base of caudal. Caudal openly emarginate; basal half scaly. Suprascapula only serrated.

Length, twelve inches. Depth, 3.6 times in length (with caudal). Length of head about the same. General color, yellow olivaceous, each scale with a dark spot at the base. Head sides, golden; top, gray.

This species differs from all those represented by *L. griseus*, in its shorter, D. 2, having 12 instead of 14 rays. In its medium number of scales and shorter muzzle it is nearest *L. buccanella*; but besides the difference in D. 2, the form is more elongate, and there is no black spot at the base of the pectoral fin.

New Providence, Bahama Is., Dr. H. C. Wood.

RHOMBOPLITES AURORUBENS, Cuv. Val. (*Centropristis*) III., 45; *Mesoprion*, Gth. I., 207; *Rhomboplites*, Gill. Proc. A. N. Sci., Phil., 1862, 237.

St. Martins, Dr. Rijgersma.

CHRYSOPHRYS CALAMUS, Cuv. Val. VI., 206; Günther I., 487.

St. Croix, Thos. Davidson.

Pristipomatidæ.

ANISOTREMUS VIRGINICUS, Linn. *Pristipoma*, Cuv. Val.; Günther I., 288; *P. rodo*, C., V.; *Anisotremus*, Gill.; Pr. A. N. Sci., Phil., 1861, 106.

St. Croix, Capt. Thos. Davidson, Dr. R. E. Griffith.

CONODON PLUMIERI, Bloch. Günther I, 304; *C. antillanus* C. V.

St. Kitts, Benj. H. Lightfoot.

HAEMULUM FORMOSUM, Linn, Cuv. Val. V., 230.

St. Croix, R. E. Griffith; New Providence, H. C. Wood, M. D.

HAEMULUM ELEGANS, Cuv. Val. V., 227; Gthr. Cat. B. M. I., 306.

St. Croix, Dr. R. E. Griffith.

HAEMULUM AUROLINEATUM, Cuv. Val. V., 227; Gthr. Cat. B. M., I., 316.

St. Martins, Dr. R. E. van Rijgersma.

HAEMULUM QUADRILINEATUM, Cuv. Val. V. 177; Günther I., 312.

St. Croix, R. E. Griffith.

HAEMULUM MELANURUM, Linnæus (*Perca*), fide Poey; *H. dorsale*, Poey *Memorias Cuba*, II., 179.

New Providence, Dr. H. C. Wood; St. Martins, Dr. R. E. van Rijgersma; St. Croix, Dr. R. E. Griffith.

HAEMULUM XANTHOPTERUM, Cuv., Val. V., 234; Günther I., 312.

Radii D X 11, 14—15; A, III, 7. Scales 6—52—11.

The specimens in the collections agree closely with the descriptions of Valenciennes and Günther. The young lack the oblique yellow bands below the lateral line. They have two indistinct longitudinal brown ones above the lateral line.

St. Croix, Capt. Thos. Davidson and R. E. Griffith, M. D.

HAEMULUM LUTEUM, Poey, *Synopsis* 369; *Memorias* II., 174.

Scales 8—59—16; Radii, D X 11, 17, A III, 8.

The specimens differ from those described by Poey, in having the spot behind the preopercular angle very indistinct, and only a part of the blue band that crosses at that point.

The eye also is 4 times in the length of the head, instead of 4.5 times, but the largest specimen is only five inches long. Nine blue longitudinal bands on a golden ground; three above, and one on the lateral line. The basis of the caudal is of a dirty shade; scarcely black as Poey describes.

St. Martins, Dr. R. E. van Rijgersma.

Scienidae.

EQUES LANCEOLATUS, Linn. Castelnau; Günther Cat. B. M., II., 279; *E. balteatus*, Cuv. Val.

Saint Croix, Capt. Thos. Davidson; Dr. R. E. Griffith, St. Martins, Dr. Rijgersma.

EQUES ACUMINATUS, Bloch. Castelnau; Gthr. Cat. I., 280; *E. lineatus*, C. V.

St. Croix, Capt. Davidson, Dr. Griffith.

EQUES PUNCTATUS, Bloch. Cuv. Val. V., 167; Gthr. I. c.

St. Croix, Dr. Griffith.

UMBRINA BROUSSONETII, Cuv. Val. V., 139.

Var. I. Depth 4 times in length; Radii D. XI—27; A, II, 6; scales, 5—58—10: nine vertical brown bars.

St. Martins, R. E. Rijgersma, M. D.

Var. II. Like the above, but deeper; depth 3.8-5 times in total length, and no vertical brown bars.

St. Martins, R. E. Rijgersma, M. D.

Günther gives scales of the lateral line, 48, and that the maxillary only reaches the line of the orbit which may be an error, as he describes from skins only: otherwise the species is different from that of Cuvier and Valenciennes.

CORVINA RONCHUS, Cuv. Val. V., 107; Günther Catal. II., 299.

St. Martins, R. E. van Rijgersma, M. D.

Mullidae.

MULLOIDES BALTEATUS, Cuv. Val. III.; *M. flavovittatus*, Poey, *Mem. Cuba* 224; Günther Cat. I., 408.

St. Kitts, B. H. Lightfoot; St. Martins, Dr. R. E. van Rijgersma.

UPENEUS MACULATUS, Cuv. Val. III., 478; Gthr. Catal. I., 408.

St. Croix, Dr. R. E. Griffith.

UPENEUS PUNCTATUS, Cuv. Val. III.; Gthr. Catal. I., 408.

St. Kitts, B. F. Lightfoot.

Scombridae.

CYBIUM ACERVUM, Cuv. Val. VIII., 186; Poey, Synopsis, 373; *C. caballa* C. V., VIII., 187; Günther Catalogue II., 373.

St. Martins, Dr. R. E. van Rijgersma.

Carangidae.

CARANX HIPPIUS, Linn; Gthr. Cat. II., 449.

St. Kitts, B. H. Lightfoot: St. Croix, Capt. Thos. Davidson.

SELAR RUBER, Bloch; *Caranx blochii* Cuv. Val. IX, 69; Günther Catal. II., 430.

St. Croix, Dr. R. E. Griffith.

BLEPHARICHTHYS CRINITUS, Akerly; Gill Pr. A. Nat. Sci., Phil., 1862, 436. *Blepharis sutor*, Cuv. Val. IX., 161; Guich. Sagras Cuba 114; Günther Catal. B. M., II., 454.

St. Martins, Dr. R. E. van Rijgersma.

VOMER SETIPINNIS, Mitch; Günther Catal. II., 459; *Vomer-brownii* C. Val. IX., 189, Tab 256.

St. Croix, Dr. R. E. Griffith.

TRACHYNOTUS GLAUCUS, Cuv. Val. VIII., 400; Gthr. Catal. II., 480.

St. Martins, Dr. Rijgersma; St. Croix, R. E. Griffith, M. D.

TRACHYNOTUS RHOMBOIDES, C. V. VIII., 407; Guichenot Sagras Cuba, 108; *T. ovatus* var. Günther Catal. B. M., II., 481.

St. Croix, Capt. T. Davidson.

PEMPHERIS MULLERII, Poey, Memorias, s. H. N. Cuba II., 203.

St. Martins, Dr. R. E. van Rijgersma.

Triglidae.

SCORPAENA GRANDICORNIS, Cuv. Val. IV., 309; Günther Catal. II., 114.

St. Croix, Dr. Griffith.

DACTYLOPTERUS VOLITANS, Linn; Cuv. Val. IV., p. 114; Günther Catal. II., 221.

St. Martins, Dr. Rijgersma.

Sphyraenidae.

SPHYRAENA BARRACUDA, Cuv. Val. III., 343, Tab. 66.

Radii D. V. I. 9, A. I. 9. Scales 10—77—15.

This specimen presents the characters by which it is said to differ from *S. picuda*, by Poey, and does not agree in many points with Günther's description of the latter. Thus the spinous dorsal commences above the distal third or fourth of the pectoral and the base of the ventral. Eye dermal 6.33 times in head; no mandibular appendage. Sides of uniform color, anal with a large black spot.

St. Martins, Dr. Rijgersma.

*Rhegnopteri.**Polynemiidae.*

TRICHIDIUM PLUMIERI, Lacep *Polynemus americanus*; Cuv. Val. III., 398; *P. plumieri* Gthr. Catal. II., 321; *Trichidium* Gill.

St. Martin's, Dr. Rijgersma.

*Scyphobranchii.**Blenniidae.*

LABRISOMUS PECTINIFER, Cuv. Val. (*Clinus*) XI., 373; *Labrisomus* Sw. Gill; Pr. A. N. Sei., Phil., 1860, 21—105; *Clinus nuchipinnis* Guthr. Cat. II., 262.

St. Martins, Dr. R. E. Rijgersma.

LABRISOMUS BIGUTTATUS, Cope sp. nov.

Radial formula ; D. XIX. I. 11 ; A. II, 16 ; the first dorsal spines the longest, last spine longer than penultimate. Length of head without opercular flap, 3.66 times in length (exclusive of caudal fin). Eye a little less than .25 length of head ; .4 greater than interorbital width. Pectoral fin to fifth anal. Scales large, counted from spinous dorsal to vent ; rows 4—46—10. Pale reddish brown, humerus red veined ; rufous specks on anterior part of sides. Seven subquadrate brown blotches from nape to caudal fin, continued with interruptions as lateral bands ; the fourth near end of spinous dorsal, black. A black spot at base of membrane between I to III dorsal spines. Two small brown spots behind orbit, the posterior on operculum. Length, 2.25 inches.

This species is well distinguished from the last by the large scales, form of dorsal fin, coloration, etc.

From New Providence, Bahamas. Dr. H. C. Wood's collection. Also a very small specimen from Dr. Rijgersma, St. Martin's.

Gobiidae.

CULIUS PERNIGER. Cope sp. nov.

No vomerine teeth. A strong spine at the posterior angle of preoperculum, directed downwards. These characters define the genus *Culius* Bleeker.

Radial formula ; D. VI. I. 9 ; A. I. 9. Lateral line 61. Head, 4.25 times in length (with caudal fin) ; depth of body, 4.75 times in same. Eye, vertical diameter, 3 times in interorbital width. Premaxillary spines not prominent in profile ; scaling of vertex extending to their extremities. Longitudinal diameter of orbit one-sixth length of head. Length five inches.

Color black, abdomen brown, fins dusky. The first dorsal with white extremity and two longitudinal black bars, one along the base. Other fins with small black bars. Maxillary or caudal spot or ocellus.

From St. Martin's, Dr. R. E. van Rijgersma.

This species is much like the *Eleotris gyrrinus*, which species is not stated to possess the preorbital armature by Cuvier and Valenciennes, and is especially omitted from the spiniferous group by Günther.*

Gobius soporator, Cuv. Val. XII., 56. Günther Catal. III., 26.

St. Martin's, Dr. Rijgersma ; New Providence, Dr. H. C. Wood.

Gobius banana, Cuv. Val. XII., 103. Günther Catal. III., 159.

St. Domingo, Wm. McGabb.

Gobiesocidae.

GOBIESOX CERASINUS. Cope sp. nov.

Head very wide, ovate, broad as long to superior basis of pectoral fin ; its length three times in the total, including caudal fin. Eye large, 3.5 times in head, diameter equal frontal width. Teeth, ten on each side of each jaw, none of the superior incisors, but the two median on each side larger than the others ; three teeth on each side below horizontal, the others vertical ; two only of the former, incisors ; the median one on each side of these much the larger. Each horizontal tooth with a small one behind it ; no canine like tooth. Profile regularly descending from supraoccipital region. A long subopercular spine. Fin radii D. VI. A. 6. C. 12. P. 24. V. 4. Dorsal beginning with the last fourth the distance between end of muzzle and basis of caudal.

Upper surfaces and fins, light crimson lake. Below whitish. No spots. Length, 2.5 inches.

**Culius amblyopsis*, Cope sp. nov.

Radial formula ; D. VI. 9 ; A. I. 8. Scales lat. line 46. Eye, long diameter, 5.5 times in that of head, twice in interorbital width. Preopercular spine strong, decurved. Width of head .6 its length ; latter 3.4 times in total without caudal. Depth 4.25 times in same. Chin prominent ; premaxillary spines forming a projection in the profile. Length three inches.

Color brown ; a black spot above at bases of pectoral fin. First dorsal and anal dusky ; second dorsal and caudal delicately cross-banded with blackish. Three black lines from orbit behind and below.

Surinam, Dr. Chas Hering.

This species resembles the *E. gyrrinus*, but has larger scales besides the preopercular spine. Three specimens.

This species is nearest the *G. rupestris*, Poey and *G. macrophthalmus*, Gth., judging by the descriptions. From the former it differs in not having the head .25 in length, nor a suddenly descending muzzle profile, nor six teeth on each side of each jaw, nor 20 pectoral radii, and in coloration. From the latter, which it resembles in color, it differs in not having the origin of the dorsal fin, two-fifth of its distance from the snout, in not having four short incisors on each side the lower jaw, separated by a canine-like tooth from the conical lateral, etc.

From St. Martin's, W. I. Dr. R. E. van Rijgersma's collection.

Epilasmia.

Chaetodontidae.

SAROTHRODUS SEDENTARIUS, Poey Mem. II., 203. *Chaetodon gracilis*, Günther. Catal. B. Mus. II., 20.

St. Martin's, Dr. R. E. van Rijgersma.

SAROTHRODUS CAPISTRATUS, Linn. Cuv. Val. (*Chaetodon*) VII. 64, Günther II., 12.

St. Martin's, Dr. Rijgersma ; St. Croix, Thos. Davidson and Dr. Griffith.

SAROTHRODUS BIMACULATUS, Bloch. Cuv. Val. VII., 67, Günther II., 9. (*Chaetodon*).

St. Croix, Capt. Thos. Davidson, Dr. R. E. Griffith.

SAROTHRODUS STRIATUS, Linn. (*Chaetodon*) Cuv. Val. VII., 10, Günther II., 8.

St. Croix, Thos. Davidson, Dr. R. E. Griffith.

HOLACANTHUS CILIARIS, Linn. (*Chaetodon*). Lacepede, Cuv. Val. VII., 154, Günther II., 46.

St. Martin's, Dr. R. E. Rijgersma ; St. Croix, R. E. Griffith ; New Providence, Dr. H. C. Wood.

HOLACANTHUS TRICOLOR, Bloch. (*Chaetodon*) Cuv. Val. VII., 162, Günther II., 49.

St. Martins, Dr. Rijgersma ; St. Kitts, B. H. Lightfoot ; St. Croix, Capt. Davidson and Dr. Griffith.

POMACENTRUS QUINQUECINCTUS, Cuv. Val. VII., 210.

St. Kitts, B. F. Lightfoot ; St. Martin's, Dr. Rijgersma ; St. Croix, Dr. Griffith.

Acanthuridae.

ACANTHURUS CHIRURGUS, Bloch. Cuv. Val. X., 168 ; Günther Catal. III., 329.

St. Croix, Capt. Davidson, Dr. Griffith ; New Providence, Dr. H. C. Wood ; St. Kitts, B. H. Lightfoot.

ACANTHURUS CÆRULEUS, Bl. Schn. Cuv. Val. X., 179 ; Günther Catal. 336.

St. Croix, Dr. Griffith, Capt. Davidson ; New Providence, Dr. H. C. Wood.

PLECTOGNATHI.

Ostraciidae.

OSTRACIUM QUADRICORNE, Linn., Hollard Monogr. Ostracionides Am. Sc. Nat., 1857, 148. Poey Repertoire, 1868, 439.

St. Martin's, Dr. Rijgersma ; St. Croix, Capt. Davidson ; New Providence, Dr. Wood.

OSTRACIUM TRIGONUM, Linn., Hollard l. c., 150.

St. Martin's, Dr. R. E. van Rijgersma.

OSTRACIUM BICAUDALE, Linn., Hollard l. c., 15 ; Poey l. c., 1868, 442.

St. Martin's, Dr. Rijgersma.

OSTRACIUM TRIQUETRUM, Linn., Hollard l. c., 154 ; Poey l. c., 442.

St. Croix, Capt. Davidson ; St. Martin's Dr. Rijgersma ; Vera Cruz, Dr. Burroughs ; Brazil, Wm. Hyde.

OSTRACIUM EXPANSUM. Cope sp. nov.

General character of *O. bicaudale* L., that is, trigonal in section, with a horn on each side of the vent, on the the basi-lateral angle. The body is short and elevated, the dorsal line rising into a hump, and descending to the base of the caudal peduncle at an angle of 45°. On the upper side of the base of the latter, a separate bony shield exists,

as in *O. trigonum* and *O. ovium*. The inferolateral sides also expand or flare out strongly at the middle of the length, making the abdominal width equal to the height. The horns are well developed. Superciliary ridges prominent, unarmed, interorbital region concave, front descending very steeply, slightly concave, not projecting beyond the premaxillary. Lateral scales a little higher than broad, all with a central clump and six radiating lines of sharply defined rounded tubercles. These cause a sharp serration of the dorsal ridge. Radii D. 10; C. 10; A. 10; caudal fin truncate. Total length (axial) 0m. 11; of shell without muzzle and caudal peduncle 0m. 0.75; greatest elevation of dorsal ridge (oblique) 0m. 0.55; greatest abdominal width 0m. 0.50; width at supercilia 0m. 0.18; total length caudal peduncle and fin 0m. 0.42.

Color, light brown, with a pale yellowish spot or area near the middle of each plate. A short chain-like band of dark brown, enclosing yellowish gray areas, extends from below the orbit to behind the axilla; a similar but narrower parallel band, exists at a point 3-5ths the distance from the last to the dorsal fin; in one specimen it is obsolete. Upper side of the caudal fin closely yellow spotted. Fins unicolor.

Three specimens from unknown locality.

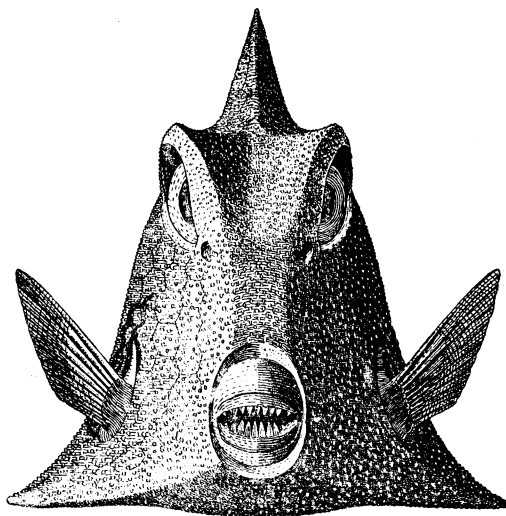


Fig. 9. *Ostracium expansum*, Cope.

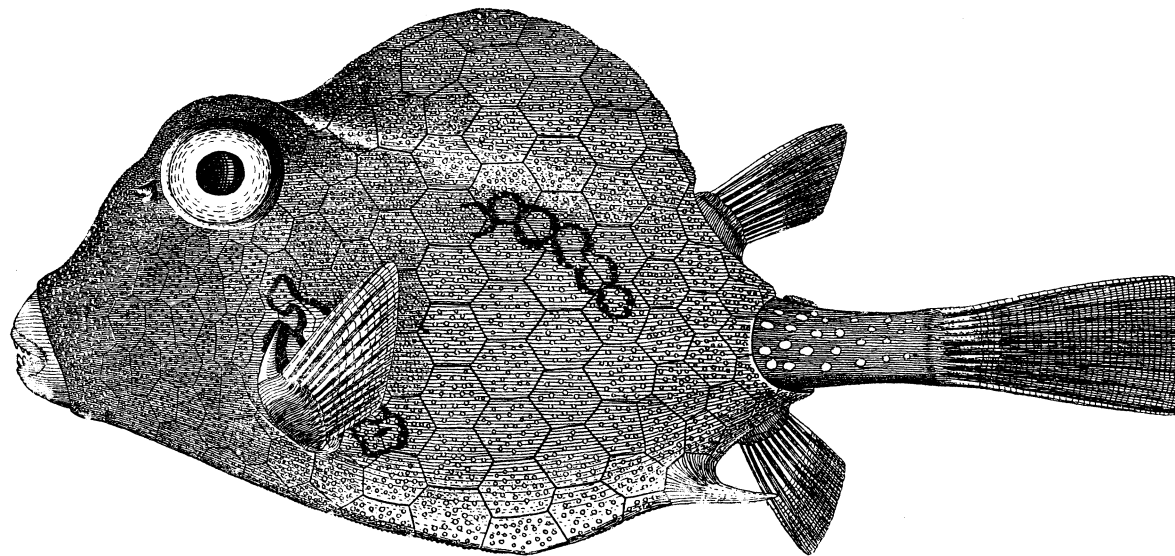


Fig. 10. *Ostracium expansum*, Cope.

This species has somewhat the form of *O. triquetrum*, but is shorter and with superior and lateral ridges more convex or expanded. It differs from that species and *O. bicaudale* in having no distinct scales over the operculum, and no fissure extending anterior to the latter, to permit movements of the respiratory apparatus.*

**CIBOTIUM FISSUM*, Cope sp. nov.

Transverse section square, convex above, without dorsal keel or tubercle. Depth between lateral angles .75 greatest width. Interorbital region plane, profile of muzzle little concave, not projecting distally. Orbit oval 2.3-5 times in length of head, equal to length of muzzle that is boxed, and equal to the length of the opercular slit. Scales with rugose radii, those beneath the orbit excavated. Length of head (to superior end of opercular slit) 4.66 times to end of caudal fin. Radii D. 9; C. 10; A. 9. Color above and laterally brown, below yellow. The sides closely marked with round blackish spots in regular uncinx, parts of three on each scale. Belly with a larger brown spot in the centre of each scale. Front and sides and end of dorsal shield with small black spots; caudal peduncle and fin brown, with black spots; other fins immaculate. Total length 0m. 1.18; of shell 0m. 0.77; width above posteriorly 0m. 0.1; interorbital width 0m. 0.19; greatest dorsal width 0m. 0.34.

Habitat unknown, probably the Indian or Pacific Ocean.

The affinities of this species are to *C. cubicum*, which differs according to Bleeker in its more concave profile, and large ring-shaped spots. As compared with *O. punctatum*, it has a shorter muzzle and longer opercular slit (whence the name) the latter entering the former in that species 2.5 times instead of once.

Balistidae.

ALEUTERES PICTURATUS, Poey Proc. Ac. Nat. Sci. Phila., 1863, 188; Repertorio, Cuba, 1868, 438.

New Providence, Bahamas, Dr. H. C. Wood. A specimen of 0m.548 in length. Radii D. 47; A. 48. St. Martins, Dr. Rijgersma.

MONACANTHUS MACROCERUS, Hollard Ami. Sci. Nat. (4) II., 327; tab. 12 fig., 1. Poey Conspectus.

St. Martins, Dr. R. E. van Rijgersma.

MONACANTHUS IRRORATUS, Poey Memorias s. H. Nat., Cuba II., 330.

St. Croix, Dr. R. E. Griffith; St. Martins, Dr. Rijgersma.

MONACANTHUS TOMETOSUS, Linnè (*Balistes*) Hollard l. c., 348; Tab., 13 f. 1.

St. Martins, Dr. R. E. van Rijgersma.

MONACANTHUS DAVIDSONII, Cope sp. nov.

Char. Allied to *M. villosus*, Ehrbg. Scales with three acute spines on a common but low base; no ventral fan; some large spines directed posteriorly on the caudal peduncle. Dorsal spine with strong teeth. Slender filaments scattered distantly over the sides. Striped.

Description. Spine of first dorsal fin one-half the depth of the body. Radii, 2 D. 30; A. 28. Pelvic plate elongate, spinous all round; abdominal margin strongly convex in front of vent, the posterior outline vertical. Spines of most of the caudal peduncle villiform, among them, six spines in two clusters of three each, one above and one below the median line. They are slender, with tips a very little recurved. Diameter of orbit about one-third length of muzzle.

The floating processes are filiform, and not subdivided; their length about equals the diameter of the eye.

Color brown, with five longitudinal brown bands with pale centres. The superior and inferior form three dark blotches at the base of each soft ray or fin. The anterior parts of the dots marked with numerous black dots. Head immaculate; caudal fin with a median brown cross-band. Depth at vent 2.2 times in length without caudal; depth at middle orbit 2.4 times in same. Length four inches.

This species is near the *M. villosus*, Ehrb., in the filamentous processes, and number of dorsal radii, but differs much in the more elongate form, the caudal spines, the scale spines and the coloration.

Habitat, the Florida Reef. Obtained by George Davidson of U. S. Coast Survey. This gentleman has devoted spare moments and favorable opportunities, found during the performance of his duties, to the pursuit of Natural History, and has enriched the museums of Philadelphia with many valuable objects. This species is dedicated to him.

MONACANTHUS SPILONOTUS, Cope sp. nov.

Char. Scales supporting a pedicle whose summit divides into four or five radiating spines. Dorsal spine long, with simple teeth behind. Brown with darker dorsal spot and streaks.

Descr. No brush or spines on the caudal peduncle. Dorsal and anal fins elevated medially, descending posteriorly rather abruptly; radii respectively, 32, 31-2. General form elongate. Depth at vent 2.5 times in length, exclusive of caudal fin; length or dorsal spine 4.25 in same; diameter of orbit not quite 3 times in length of muzzle. Pelvic shield narrow, posterior movable portion present; spines all round. Outline of front straight. Length three inches.

Color light brown, some longitudinal lines just below the dorsal fin, the median developing a dark spot below the middle of the soft dorsal.

Three specimens from the Gulf of Mexico, obtained by Capt. Baker.

The structure of the scales reminds one of that of the *M. tricuspis* of Hollard, but there are but three points on those of the latter ; it has also strong spines on the caudal peduncle, which are wanting here.*

MONACANTHUS AMPHIOXYS, Cope sp. nov.

Scales with a single spine ; no larger spines or brush on the caudal peduncle. Radii D. 35 ; A. 30. Dorsal spines anteriorly with two rows of small spinules directed downward, and a single median series directed upward, near the base on each spine of the lateral series, is a short branch-spine directed upward. A very weak series of spines extends down each side of the posterior face. The directions of the anterior and posterior rays of the second dorsal are convergent. The pelvic plate is short, without movable portion, with two spines directed forward, two backward and three on each side upwards. The orbit is contained three times in the length of the muzzle in an individual of two inches long. No preanal expansion. Anal depth 2.5 times in length without caudal fin ; length to upper opercular slit 2.66 in same ; depth at pelvic plate, one-half same. Dorsal and anal membranes not perforate at base.

Color, uniform leaden.

St. Martins, Dr. R. E. van Rijgersma.

This species appears distinct from those described. Poey, Repertorio, 1868, 437, mentions a species *M. punctatus*, of which I can find no full description. He enumerates its differences from *M. irroratus*, Poey, and as he does not include those of the scales and dorsal spine, the present is probably a different fish. In the dorsal spine it is especially different from the *M. irroratus* and all other species I have seen.

**MONACANTHUS SANDVICENSIS*, Q. G. Voyage d'Uranie Zoologie, 1824, p. 214.

This is another species allied to the *M. granulatus*, but without the barbs which arm the posterior face of the dorsal spine in that fish, and with a larger number of fin radii.

Scales with a single simple spine, no larger spines or brush on the caudal peduncle. Pelvic bone broad ovate, with remarkably small spines on its circumference. Dorsal spine very long, its length 4.5 times in length without caudal, its base over the middle of the orbit. A series of short weak spines on the sides of the basal third of the dorsal spine ; anteriorly several rows of small asperities. Radii D. 36 ; A. 31 ; the anterior part of both fins much elevated, the rays of the posterior portion rapidly shortening and directed forward. Front slightly convex ; upper teeth projecting beyond mandible. Orbit three times in muzzle to edge of lip. Anal depth 2.33 times in depth to origin of caudal ; pelvic depth 1.66 in same. Line from pelvic plate to vent, straight, acute. Length four inches. Color uniform brown.

From the Sandwich Islands. Discovered by Jno. K. Townsend.

MONACANTHUS HOMOPTERUS, Cope sp. nov.

This species is near the last in the characters of the scales, pelvic bone (which has, however, stronger spines anteriorly and posteriorly) the character of the dorsal spine, the number of fin rays (D. 35 ; A. 30), and the general proportions. It differs as follows: The rugosities on the sides and front of the dorsal spine are in close contact, and not separated by smooth spaces as in *M. sandvicensis*. The radii of the second dorsal and anal are subparallel and subequal, the anterior rays lacking the prolongation seen in many species, and the posterior not being anteriorly directed as in the last. Orbit four times in muzzle. Depth at vent 2.4 times in length without caudal ; at pelvic bone a little more than one half. Fin membranes not perforate.

Color light brown ; fins very light. Length 2.5 inches.

Locality said to be Australia ; from Wm. Wood.

MONACANTHUS HYPARGYREUS, Cope sp. nov.

Scales with a single, simple spine. Radii D. 34 ; A. 33 ; the membrane perforate at the base. Dorsal and anal fins elevated anteriorly (at 6 and 7 ray), and gradually descending posteriorly as in some Carangoids, the radii all directed posteriorly, the inter radial membranes perforated at the bases. Pelvic plate small, with a few spines. Depth at vent 3.6 times in length, exclusive of caudal fin. The form is hence elongate, the profile nearly straight, the lower jaw a little longer. Diameter of orbit one-half the length of the muzzle. Dorsal spine above middle of orbit without spines posteriorly, with two rows in front and one on each side. Length three and a half inches.

The superior half of the body is light rufous in spirits, the inferior half silvery white.

Two specimens supposed to be from Australia ; from Wm. Wood.

This species is of the type of *M. vittatus*, Sol., and *M. paragaudatus*, Rich. It is nearer the former, which, according to Steindachner,* has a smaller orbit ($\frac{1}{4}$ th head), four lateral bands and fewer fin radii. The posterior limb of the orbit falls above the opercular slit, in *M. hypargyreus* behind it.

*Sitzungsberichte Wien. Academie, March, 1866.

BALISTES VETULUS, Linn., Hollard Ann. Sci. Nat., 1854, 305. Poey Repertorio, 1868, 434.
St. Martins, Dr. Rijgersma ; St. Croix, R. E. Griffith, M. D. ; St. Kitts, B. H. Lightfoot.

BALISTES PICEUS, Poey, Proc. Acad. Nat. Sci., Phila., 1863, p. 180.
St. Croix, R. E. Griffith, M. D.

BALISTES MORIBUNDUS, Cope sp. nov.

This species belongs to the section of the genus with shields above the axilla, but whether to any of Hollard's subsections seems doubtful. The scales are furnished with two rows of delicate spines, several in an anterior curved row, and two in a posterior. Thus the characters are like those of some of the bristly *Monacanthi*. The form is elevated, and the third dorsal spine is long ; there are no spines on the caudal peduncle.

Radii, D. 29 ; A. 26 ; none of those of either fin prolonged. Caudal regularly convex. Dorsal spine bristly in front. Pelvic bone elongate, spinous behind. Pelvic depth twice, humeral depth 2.25 times in total length. Diameter of orbit twice in muzzle. Anterior teeth acuminate. Cheek-scales numerous rugose, no naked fissures. Profile nearly straight. Length of dorsal spine 1.5 times orbit. Eight rather long post-pelvic radii.

Color brown, with many blue spots all over the sides of the head and body, the pelvic and gular regions unicolor. Three black spots at the base of the second dorsal fin, one at the base of the first. Length 2.5 inches.

St. Martins, Dr. R. E. van Rijgersma.

BALISTES ASPERRIMUS, Cope sp. nov.

Division I. A. of the genus, of Hollard ; that is, the scapular squamation similar to that of the sides, and the third dorsal spine well developed ; the cheek-scales not separated by naked fissures.

The scales possess a convex vertical series of short acute spines, with a median large spine directed backward from the middle of the series. Its anterior margin is sharp, and its anterior base supported by a number of convergent ribs. The spines of the dorsal scales have a branch-scale at the base in front. The cheek-scales are very numerous and not larger than those of the body. Radii D. 26 ; A. 24. Orbit large 2.25 times in muzzle, four times in head. Dorsal spine long, stout, with four rows of spinules, smooth behind. No larger caudal spines. Caudal fin convex, without projecting angles.

Pelvic depth 1.8, humeral 2.2 times in total length ; anal depth 2.4 times in the same. Length three inches. Profile nearly straight, interrupted by the convex orbital margin.

Color, brown above, yellowish below. Four longitudinal dark brown stripes above the middle of the side, which break into spots posteriorly. Three brown spots at base of dorsal fin. Belly with broad irregular dark bands ; on the caudal peduncle and pelvic region similar broad bands form a coarse reticulated pattern. Fins brown spotted.

Locality uncertain, but probably St. Martins, W. I.

This species is quite distant from its allies *B. macrops* and *B. sobaco*, of Poey.

BALISTES MELANOPTERUS, Cope sp. nov.

Nearly related to the last, and of the same section of the genus. Its characteristic differences from *B. asperrimus* are seen in the scales, which are only spiniferous on the posterior middle of the side, and on the caudal peduncle, instead of being so over the whole body ; in the first dorsal ray which is rugose, not spiniferous ; in the increased number of dorsal and anal radii, in the interorbital region, which is convex in cross section, not concave ; and finally in color.

Radii 2 D. 24 ; A. 21. Anterior rays much larger than posterior, but not produced beyond the membrane. Extremity of caudal fin slightly rounded. First spinous dorsal ray as long as from orbit to rictus oris, rugose, the rugæ almost spinous distally, the points all directed forward, not outward as in *B. asperrimus*. Third spine well developed. Scales with three rows of spines on the posterior, and four on the anterior part of the body. On the former, one anterior is prominent and directed backward, some ten rows being most marked ; they disappear toward other parts of the body, and the smaller spines become tubercles. The whole surface of the scale is covered with these, and the

radiating ridges which converge towards them. The scales on the scapular region are very small. Pelvic plate, narrow, without joint, cheek-scales in transverse series. Post-pelvic rays indistinct or wanting.

Diameter of orbit twice in muzzle and teeth; front convex in profile, head rather acuminate; anal depth 2.66 times in same. Length of head (to branchial slit) 3.33 in the same. Length four inches.

Color blackish above, brown below, spotted except on the head and anterior part of the back with pale brown spots smaller than the pupil. Unpaired fins uniform black.

From Darien; collected by J. Petigru Carson of the Darien Expedition.

BALISTES SOBACUS, Poey, Memorias II., 324; Repertorio h. n., Cuba, 1868, 434.

St. Martins, Dr. Rijgersma; large specimen.

XANTHICHTHYS CICATRICOSUS, Poey (*Balistes*) Memorias s. n. H., Cuba, II., 327. Repertorio s. h. n., Cuba, 1868, 435.

St. Martins, Dr. R. E. van Rijgersma; St. Croix, Dr. R. E. Griffith.

Tetrodontidae.

CANTHOGASTER CAUDICINCTUS, Richardson voyage Herald, 1854, 162, Tab. XXX. fig. 1, 2, 3. *Tetraodon ornatus*, Poey, Repertorio h. n., Cuba, 1808, II. 244.

St. Martins, Dr. R. E. van Rijgersma.

TETRODON RETICULARIS, Kaup voyage Herald, 1854, 161, Tab. XXXI.

St. Martins, Dr. Rijgersma.

TETRODON SPENGLERII, Günth., Cat. B. M. VIII.

Belly spinous to vent, back in a small patch from the occiput to above the tips of the ventral fins. Radii D. 9; A. 7. Head 3.25 in total length, eye 4.5 in head, 2.5 times in muzzle. Short (white) dermal processes on the sides of the body, and posterior part of the head. Tips very papillose within. Muzzle narrow, straight, gently descending in profile; width of frontal bone only .6 of eyes diameter. Dorsal and anal fins opposite; the body at that point as wide as or wider than deep. Caudal fin rounded. Length, 4.5 and 5 inches.

Color reddish dark gray above, with a few transverse interrupted dorsal shades; the sides clouded with faint brown spots. A straw yellow band from the chin through the axilla to base of tail, bounded below by a series of about twelve strong brown spots. Caudal fin with a white ring at base, then a transverse brown band, then an equally broad yellow one; the end for the same width, brown. Belly, yellowish white.

St. Martins, W. I., Dr. Rijgersma; New Providence, Dr. Wood; Tortugas, Jas. Roosevelt.

This is probably the *T. lagocephalus* of some others, but it is not the fish described under that name by Bloch. The latter has a smooth dorsal region like the *T. lacnigatus*, no dermal appendages, and a spotted belly, besides other characters it is much more like the *T. spengleri* of Bloch, but that species has a more extensive patch of dorsal spines, and a caudal fin of uniform color, besides presenting other generic characters. According to Bloch it comes from the East Indies.*

*TETRODON FLOREALIS, Cope sp. nov.

Belly to vent, and anterior part of sides with strong distant bristles, back to end of pectoral fin and head above to nares, with distant weaker bristles. No dermal appendages. A groove from the orbit to the tail on each side of the back, which are nearly connected by a medially interrupted cross-groove at the occipital crest. A groove concentric with and within the superciliary margin extending to the preocular region and returning, but sending also a curved branch round the front of each nostril. Eye, 4.25 times in head, 2.75 times in muzzle; head, 3.66 times in total length. Anal fin behind dorsal, both subfalcate narrow, rays D. 8; A. 7. Caudal long, truncate or slightly concave. Interorbital region concave, profile regularly descending. Length, five inches. Below immaculate white, a yellowish band on the sides; above reddish brown, ground reduced to narrow lines by the innumerable small light (? white) spots with a ring of smaller spots around each, over the upper regions of the head and body. Caudal fin delicately cross-barred; other fins unicolorated.

Two specimens from the Sandwich Islands, obtained by J. K. Townsend twenty years ago. This species is allied to the *T. a'boplumbeus* Richn., but differs in the fewer fin rays, as well as the color.

AROTHRONOPHYAS, Cope sp. nov.

Form elongate, the head one-third the length to the base of the caudal fin; distance from basis 1st dorsal ray to caudal fin, $3\frac{1}{4}$ times in length from caudal. Jaws nearly equal, eyebrows prominent front concave, profile of muzzle horizontal. Eye entering six and three-

Diodontidae.

DIODON ATINGA, Linn., Poey Repertorio, Cuba, 1868.

St. Martins Dr. Rijgersma ; New Providence, Dr. Wood ; Tortugas, Mr. Roosevelt.

Var. with spotted abdomen, from Panama, Dr. Ruschenberger.

DIODON HYSTRIX, Linn., *Paradiodon* Bleek., Poey Repertorio, Cuba, 1868.

St. Domingo, Edw. L. Clark.

CHILOMYCTERUS GEOMETRICUS, Bl. Poey Repertorio, Cuba, 1868.

Tortugas, Jas. Roosevelt.

HETEROSOMATA.

Pleuronectidae.

RHOMBODICHTHYS LUNATUS, Linn., Günther Catal., IV., 433. *Rhombus argus*. Cuv. Regne Animal.

St. Croix, Capt. Davidson, Dr. Griffith ; St. Martins, Dr. Rijgersma.

PEDICULATI.

Antennariidae.

ANTENNARIUS MARMORATUS, Lesson, Bloch. Cuv. Val. XII., 397 ; Günther Catal. III., 185.

St. Martins, Dr. Rijgersma.

ANTENNARIUS MULTIOCELLATUS, Cuv. XII., 420. Günther Catal. III., 194.

St. Martins, Dr. Rijgersma ; St. Croix, Capt. Davidson.

Lophiidae.

MALTHE VESPERTILIO, Linn., Cuv. Val. XII., 440. Günther Catal. III., 200.

St. Martins, Dr. Rijgersma.

LOPHOBRANCHII.

Syngnathidae.

SYNGNATHUS, sp.

St. Martins, Dr. Rijgersma.

HIPPOCAMPUS GUTTULATUS, Cuv.

St. Martins, Dr. Rijgersma.

HEMIBRANCHII.

Fistulariidae.

AULOSTOMA COLORATUM, Müll. Trosch. Schomb. Hist., Barbadoes, 673. Günther Catal. B. M., III., 536.

St. Croix, Dr. Griffith, Capt. Davidson.

PERCESOCES.

Atherinidae.

ATHERINA STIPES, Müller and Troschel in Schomb. Hist., Barb., 671. Günther Catal. B. M., III., 400.

St. Martins, Dr. Rijgersma.

quarters times the length of the head, and 3.2 times the median interorbital space. Olfactory tentacles separated to base. Dorsal and anal fins with contracted bases, higher than long ; rays D. 10 ; A. 10, P. 16. Spines generally short, longest on the belly, a very few between orbit and operculum. The dorsal spines commence between the posterior margin of the orbits, and extend above the basis of the pectoral ; the laterals, to the anterior line of the anal, except in a band from the pectoral where they seem to be wanting : caudal peduncle chln and throat smooth. Length 0m.38, (15 inches) depth at operculum 0m.07.

Color, everywhere except on the belly, blackish, paler at base of caudal ; belly yellow (white). Numerous small (.002m.) ? yellow spots everywhere, arranged more or less in lines or in quincunx. They are more numerous posteriorly and on the lower regions. They are also larger below, and vanish in the pale line of the belly. Caudal fin yellow (white) spotted, other unpaired fins uniform brown ; pectoral pale, very dark at base.

This fine species was brought from the Navigator Is'ands, in the Pacific, by Dr. H. C. Caldwell. Its affinities are evidently to such species as *A. kappa*, Russell, and *A. meleagris*, Richdn., but its slight spinous development and color, distinguish it from the numerous species of the genus now known.

Mugilidæ.

MUGIL BRASILIENSIS, Agassiz Spix. Pisc., Brazil, p. 234, fide Günther Catal. III., 431.

St. Croix, Capt. Davidson; New Providence, Dr. H. C. Wood.

SYNENTOGNATHI.

Scombresocidæ.

EXOCOETUS AFFINIS,* Günther Catalogue British Mus., VI., 288.

St. Martins, Dr. H. E. van Rijgersma.

CYPSILURUS HILLIANUS, Gosse. Nat. Soj., Jamaica, p. 11; Poey, Memorias, Cuba, II., 301; Günther Catal. B. M., VI., 284.

St. Martins, Dr. H. E. van Rijgersma.

HEMIRHAMPHUS UNIFASCIATUS, Ranzani, *H. richardi*, Cuv. Val. XIX., 26. *Hemirhamphus unifasciatus*, Günther Catalogue VI., 262.

St. Martins, Dr. van Rijgersma. Saml. Powell obtained a specimen of this fish at Newport, R. I. I cannot find that it has been previously recorded from the coasts of the United States.

HEMIRHAMPHUS PLEII, Cuv. Val. XIX., 21.

St. Kitts, B. H. Lightfoot; St. Croix, Capt. Davidson, Dr. Griffith.

BELONE DIPLOTAENIA, Cope sp. nov.

Anterior dorsal and anal radii elongate, median and posterior dorsal radii equal. Caudal peduncle very much depressed, wider than deep, but without any keel or trace of one. No teeth on the palate.

Jaws equal, not mentioning the elongate mandibular dermal process. Length of head 2.66 times in length to base of inferior caudal border. Diameter of orbit just equal to interorbital width, and 2.5 times into postorbital space. Pectoral fin equal same space. Top of cranium nearly smooth, groove interorbital only, shallow, with median ridge. Maxillary bone concealed by preorbital, except an anterior terminal lobe. Form of body cylindric. Fin radii D. 16; A. 17; dorsal commencing above fourth anal ray. Caudal fin moderately emarginate. Total length 0m.35. From end muzzle to rictus oris 0m.062; to opercular border 0m.101; ventral fin 0m.176; anal 0m.22; lower basis caudal 0m.275. Twenty-three rows of scales between dorsal and anal fins.

Color in spirits; above brownish (probably green in life), below silver white, a blue band extends from the opercular angle to near the origin of the caudal fin. This is on the median, part of its length black edged below, and then yellow margined throughout its entire length below the black, and for a width equal to itself, i. e. 1.5 rows of scales.

St. Martins, Dr. R. E. van Rijgersma.

This species is one of the most elegant of the genus, and differs from the others already known from West Indian seas. Neither the works of Poey, Valenciennes, nor Günther contain the present one. Its maxillary bone, concealed for most of its length, and emarginate caudal fin separates it from the species allied to *B. truncata*. In *B. galeatus* C. V the head is much shorter, entering the length 3.5 times.

BELONE MACULATA, Poey Memorias, Cuba, II., 290.

St. Kitts, B. H. Lightfoot.

BELONE CARIBBAEA, Lesueur Journ. Ac. N. Sci., II., 127, C. V., 430; Günther, VI., 241.

Loc?

**Exocoetus scylla*, Cope sp. nov.

Ventral fins extending nearly to end of anal; pectorals extending to a little beyond the same point, uniformly colored. Orbit not quite equal to muzzle, 3.6 times in length of head, and .66 times in the flat interorbital space. Teeth very minute. Scales; l. l. 59, eight rows from it to dorsal fin, and 27 scales in front of latter. Fin rays D. XI; A. 11. Head one-fifth of total length (with caudal). Origin of ventral half way between margin of operculum and inferior basis of lower caudal lobe origins of dorsal and anal opposite. Color yellowish silvery: fins white, except part of edge of pectoral, which is dusky.

Total length 0m.255; to upper base of pectoral 0m.05; to basis ventral 0m.117; to basis anal 0m.148. Depth of body 0m.034, in front of ventrals. From the Coast of the Gulf of Mexico, said to be near Tobasco, Mexico. Discovered by Dr. Berendt.

Near the *E. californicus* of Cooper.

ENCHELYCEPHALI.

Congridæ.

CHILORHINUS SVENSONII, Lütken Vid. Med. Forel. Kjobenhavn, 1851, No. 1, Günther Catal. B. M., VIII., 51.

Char. gen: Fam. *Congridæ*; sub-fam. *Myriiformes* (Bleeker). No pectoral fins; no vomerine teeth. Anterior nostrils concealed beneath the lip near the orbit; posterior (anterior in position), not tubular, but apparently in the edge of the upper lip on each side the muzzle. Caudal fin continuous.

This genus appears to be nearest the *Muraenichthys* of Bleeker, especially in the lack of pectoral fins: it differs from it in the inferior position and more tubular character of the nares of the muzzle, and in the absence of vomerine teeth.

Char. specif. The anus measures the anterior two fifths of the length, and the anal fin commences immediately behind it. The dorsal fin commences at a point half way between the vent and the end of the muzzle. The fins are narrow. The body is compressed throughout, the muzzle depressed. The form is stout, the depth entering the length only nine times. Eye entering interorbital width 2.5 times; latter equaling length of muzzle. Two series of shortly conic teeth on the palatines (Cuv. maxillaries meckel), and ten in two transverse rows on the premaxillary nasals. Three series on the dentary near the symphysis to elongate teeth. Length m.0.08. Color, uniform dark brown; throat paler; fins darker margined.*

From Id. St. Croix, West Indies, Capt. Thos. Davidson Coll.

PISOÖDONTOPHIS LATIMACULATUS, Poey Mem.

St. Martins, Dr. Rijgersma.

Anguillidæ.

ANGUILLA BOSTONIENSIS, Leseuer Journ. A. N. Sci., Phila.

St. Martins, Dr. Rijgersma.

COLOCEPHALI. †

ECHIDNA CATENATA, Bloch.; *Poecilophis catenatus*, Kaup; *E. flavofasciata*, Poey Repertorio Fis. Cuba, II., 264 (*vide* Günther).

St. Martins, Dr. Rijgersma.

GYMNOTHORAX MILIARIS, Kaup. Catalogue Brit. Mus., 90.

St. Martins, Dr. Rijgersma.

* *Ophichthys stenopterus*, Cope sp. nov.

Tail nearly twice the length of the head and body. Front convex longitudinally and transversely. Palatine and mandibular teeth in two rows, the former throughout their length. Vomerine teeth in two series, here and there in three. Eye twice in muzzle. Length of pectoral fin five times in length of head, dorsal commencing above at point $1\frac{1}{2}$ length of the fin behind its extremity. Dorsal and anal fins very low; both at their anterior portions a mere fold. Length m.0.32; of head (to branchial slit) m.0.025. Superior half the body brown, inferior white. Anal and dorsal fins white. Two specimens from Japan, presented to the Mus. Academy Nat. Sciences, by Dr. A. A. Henderson.

This is one of the slender species of the genus, and is near the *O. lumbricoides* of Bleeker. It differs in the more numerous palatine teeth, more posterior origin of dorsal fin, and very much less elevated dorsal and anal fins, not having more than half the extent figured by Bleeker in his Atlas Tab. XLVIII., fig. 3.

† *Holopteurura plumbea*, Cope gen. et. sp. nov.

Char. Gen. Anterior nostrils (posterior in position) concealed within the lip in front of the eye; posterior nostrils tubular, deflected and posterior to the apex of the muzzle. Branchial slits approximated below the small pectoral fins. Extremity of tail finned. Vomerine teeth present; no canines.

This is *Sphagebranchus* with caudal fin.

Char. specif. Tail 1.5 times the length of head and body. Dorsal fin commencing two lengths of the head behind muzzle. Profile, flat, muzzle narrow; interorbital space less than muzzle, equal twice diameter of orbit. Mandibulars and vomerines, two rowed in front, one-rowed behind; palatines two-rowed throughout. Total length 0^m.227; of head 0^m.025. Color brown above, leaden below.

West Africa, Dr. Goheen.

GYMNOTHORAX ROSTRATUS.

St. Martins, Dr. Rijgersma; St. Kitts, B. H. Lightfoot; New Providence and Bahamas, H. C. Wood, M. D.

GYMNOTHORAX NIGROCASTANEUS, Cope spec. nov.

Dorsal fin commencing above a point three lengths of the gape behind the end of the muzzle. Anterior part of head much attenuated; mandible longer than muzzle; orbit horizontally oval, its diameter entering the muzzle twice, and the interorbital width once. Posterior nostrils a long and open slit equal two-thirds the diameter of the eye, commencing on a line with its anterior margin. Anterior nareal tubes behind the end of the muzzle, short. A single row of ten small teeth on the posterior part of the vomer; then three widely spaced elongate teeth on the front, and an arched series of six teeth on the outer margin of the naso-premaxillary. Two series of maxillo-palatines, the outer smaller, mingled with still smaller, the inner larger, and freely articulated three in front and four behind. Mandibular teeth one-rowed, four spaced long ones in front, twenty-five shorter, closely set acute ones behind.

Color dark chestnut, without markings. Top of head and borders of dorsal and caudal fins black. Length 0m.65; to branchial slit 0m.077; to vent 0m.36.

St. Martins, Dr. R. E. van Rijgersma.

This eel appears to be allied to the *G. infernalis* and *G. erebus* of Poey, but the dorsal fin commences at a point much posterior to that seen in those species, and there are fewer teeth. I only know the latter from Dr. Poey's description.

ISOSPONDYLI.

Clupeidæ.

CLUPEA MACROPHTHALMA, Ranzani. Günther Catal. Brit. Mus. VIII. 421.
New Providence, Dr. Wood.

CLUPEA HUMERALIS, Cuv. Val. XX. 293. Günth. Cat. B. M. VII. 422.
St. Croix, Capt. Davidson; St. Croix, Dr. Griffith.

ELASMOBRANCHI.

SQUALI.

Scylliidae.

GINGLYMOSTOMA FULVUM, Poey, Memorias, II. 342. Tab. 19. f. 15. Repertorio, 1868, 455.
St. Martins, Dr. Rijgersma.

GINGLYMOSTOMA CIRRATUM, Gmelin. *S. punctatus*, Parra. *S. argus*, Bancr.
St. Martins, Dr. Rijgersma.